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ANTON DOHRN[1]

To speak of Anton Dohrn before zoologists is both easy and difficult. Many, perhaps the greater number, of you have known him personally, some longer and better than I; and all know his work. Of his aims and their attainment he has left us his own graphic recital full of personal charm; and others have paid tribute to his achievements in a manner so incomparable that I can not hope to bring to you anything new. But I have been encouraged in this undertaking by the thought that I do not first need to arouse in you sympathy for his personality. What I have to say will awaken in most of you an answering chord, recalling so many varied reminiscences that my aim will be accomplished, even though my words fail in their expression. So bring back to your mind the image of the beautiful white building with its red loggias, against the dark background of green ilex; picture this building as it stands on the shore of the Bay of Naples. Upon the facade zoologists read with pride the words "Stazione Zoologica," telling each one that here stands a temple of science symbolizing their aims and ambitions. More than two thousand square meters are covered by this building containing more than 150 rooms, in which fifty persons, officials, technicians, artists, fishermen and laboratory servants are continuously engaged in work. At Easter time the visitor to the station will find there as many

[1] Memorial address delivered at the International Zoological Congress, Graz, August 18, 1910, by Dr. Theodor Boveri, professor of zoology and comparative anatomy, Wurzburg. (Translated for SCIENCE.)

as eighty investigators busily occupied, and a tour of inspection from room to room in reality carries him through the whole range of biology. In the course of thirty-six years many embryonic biologists have been attracted here to study for the first time the wonders of marine life. Here investigators have come from every civilized land, because the scientific problems they had in mind could nowhere else be studied to such advantage. How many hours of happy work, how much of the joy attending discovery, has this building seen! The tables of the station have been occupied more than 2,000 times, while the number of scientific experiments either originating or deriving their inspiration here can not be estimated. Add to this total all that the station itself has contributed to scientific work; the help given to zoological investigators by the *Jahresbericht;* the material supplied for museums throughout the world, as well as for teaching purposes, and last but not least recall the fact that this institution since its foundation has served as model and inspiration for the establishment of zoological stations in many different countries. Remembering all this, we can but echo the words of the address delivered at the station's International Jubilee Celebration in 1897:

> We can not imagine what the position of the biological sciences would be at this time had the far-reaching influence of the station been eliminated.

Should we wish to express as briefly as possible what this influence has been we would say that Dohrn's Station first made the study of marine life practical. For a long time occasional soundings had been made by a few persons, and they had revealed the hidden treasure. Similar institutions were established about the same time as Dohrn's by contemporary leaders in the field of zoology, Henri de Lacaze-Duthiers and, in America, Louis Agassiz, not to mention other smaller undertakings. But in making the great treasure available Dohrn was the first, and this marks the importance of his work in comparison with all others. In this we have an objective measure of his work. Each one of us, profiting by the studies made at the Naples Station and conscious of having added another stone to the growing structure of our knowledge, must imagine his own part increased a thousandfold, if he is to measure the entire scientific contribution made possible by Dohrn's creative genius. With this in mind we must realize how immeasurable was the influence he exerted on biology. Not only does time fail me, but I am not in the possession of the facts necessary to follow in detail the course of the newer streams of knowledge arising in the zoological station, and spreading out over the most widely separated fields of biology. I shall direct your attention to only one branch in the wide field of enquiry carried on in the station, namely, that which may be described under the head of causal morphology. Judged by what has been gained in the study of marine organisms and realizing that without the opportunities offered by these stations the results would have been unattainable, the part taken by the oldest and largest of these institutions at one of the most critical moments in the history of our science entitles it to the highest reward.

Anton Dohrn, the man to whom we owe all this, was born December 29, 1840, in Stettin, now almost seventy years ago. When one hears his father's personality described there is no doubt that the son resembled him in outward appearance and inherited from him what was best in his parent's character. The possession of ample means permitted the elder Dohrn to order his life according to his inclinations.

To live life to the full, as Goethe expressed it; to develop all his inherent powers; to take as comprehensive a view as possible of all fields of learning, these were his guiding principles. In the house of this unusually talented musician were heard artistic renderings of the chamber-music of Beethoven and Schubert, while as an accomplished linguist he made finished translations of Spanish dramas. Far and wide he was known as an entomologist, as well as the founder and director of an influential entomological journal published in Stettin. These and other undertakings enlivened an immense correspondence which he carried on with a circle of prominent men, and such relationships were further developed by frequent journeys to Italy, which country of all others gave the greatest pleasure to this man, fascinated by the beauties of nature, antiquities and the charm of Italian life.

In such surroundings, with three equally gifted brothers and a sister, Anton Dohrn grew to manhood, and those who knew him well recognized in him many of the qualities possessed by the father. At seventeen years of age, this precocious youth (who had already passed without difficulty through the gymnasium) published articles in entomological periodicals. We can imagine him on the threshold of the university, full of strength and love of life, abounding in enthusiasm for a multiplicity of interests, developed under the father's influence, and by unusual teachers. The world as Goethe saw it was his confession of faith. Dohrn himself regarded it as an accident that with his traits he should in those times have become a zoologist. The entomological leanings of the father, who had interested his three sons while yet boys in the art of collecting insects, gave the first impulse in this direction, but his real interest was not yet aroused. What could zoology as it was taught in his student years, in the early sixties in Königsberg, Bonn and Berlin, offer to his hungry mind? Disappointed at the time already lost, he had the notion of giving up his studies and becoming a publisher, when the appearance of Darwin's work brought an illuminating ray suddenly into his life. When we consider how many of us have been drawn into biology, from widely separated fields of interest, by the doctrine of descent looming up before our minds, we can easily imagine what an anchor of safety was offered by this vision to a young zoologist of Dohrn's temperament and education, already despairing of his ground. Here was the turning point in the life of one who scientifically was in despair. At one bound zoology took for him its place as the central point of all knowledge. What had appeared to his mind as without continuity, suddenly became most perfectly connected. Like many others of his time and later, he had the feeling that here if anywhere the riddle of our being must find a solution. Without doubt the manner in which the new teachings were presented by Haeckel and Gegenbauer must have had great influence on this revolution of his thought processes. Following the advice of these two men, he matriculated in 1868 at Jena, and it appeared at first as if his life too would find its aim and end in the chair of a professor of zoology, but Dohrn's personality forced itself out from this career and created a new sphere of existence. Later he gave two reasons for breaking away from the academic career. Often when working by the sea he had felt the great need of laboratory facilities. A profitable field of activity in Jena hardly seemed longer possible, as a result of an increasing divergence of his scientific views from those of Gegenbauer and Haeckel. Little as we can doubt the strong influence of these motives,

it seems to me that they were only the expression of an impulse, unconscious perhaps to Dohrn, to bring those powers into play, which as privatdozent, he would be forced to suppress. He longed to create something great all his own, to wander on new and untrodden paths. This desire showed itself in his earlier project to become a publisher, as it was his wish to choose a field of practical activity affording full play for his intellectual talents. When the earlier indifference towards the adopted science had been changed into enthusiasm, this impulse, as a matter of course, chose for its objective, zoology. Beginning with taxonomy, imbued with Darwinian theories and accepting transmutation as a physiological problem, he had already gained a comprehensive view of the needs of his science. He had ever before his eyes the lesson the sea had taught some of his fortunate predecessors, especially as recorded in the brilliant results of Johannes Müller's work. His own experience had often shown him how much more advantageously these marine organisms could be utilized if the experimenter, hurrying from inland to the coast for a short season, found there even a primitive laboratory. The founding of a marine zoological station offered the needed medium for the expression of this strongly felt impulse to develop his great personal powers.

In the winter of 1870, Dohrn went to Naples, hoping to realize his plan, but the negotiations entered into were soon interrupted by war which recalled the young officer to Cassell (on account of an earlier illness he had been transferred to the reserves). In the fall of 1871 Dohrn removed permanently to Naples, and forthwith began the great constructive period of his life. To-day the biologist comes to Naples and sees the Zoological Station standing in the public gardens, of which it is almost an integral part. On going to work he finds not only the material for his experiments, but apparently everything needful for their elaboration, even complicated and specialized equipment being brought to him with business-like promptness. In addition he has easy access to a library of such completeness as nowhere else could be at his disposal—in brief, when the occupany of a Naples table, a veritable "Tischlein deckt dich" allows him to concentrate his thought entirely on his work, he accepts all in its completeness without realizing the indescribable toil and self-sacrifice with which this now perfect institution has been brought into existence. And I too must confess that even though I had known the station in its beginnings and had read and heard much as to its origin, it was first through the manuscripts left by Dohrn in which he speaks of the formative years that it became clear to me what courage, what self-denial, what inexhaustible patience, what an intimate acquaintance with the most varied realms of knowledge, what an art for grasping situations and handling men, had been brought into play in this creation. Dohrn himself, speaking twenty years later of this time, said:

> It now often seems to me as though like a sleep-walker I had safely passed all the pitfalls that lay on either side of my way. Without a model as precedent, with entirely insufficient pecuniary resources, absolutely without business knowledge, in a foreign land, of whose language I knew little or nothing, I signed an agreement with the authorities of the city which of all others in Italy is the most difficult to administer. From the time of the first negotiations in the city hall in Naples, in November, 1870, to the opening of the station in February, 1874, I passed through an Odyssey of wanderings.

Do we hear in these words the approach of that period in life when in retrospection one doubts the power of youth (even one's own) to have accomplished what has been

done and which perhaps one is no longer capable of doing? His own words make us realize the size of the undertaking to which Dohrn had committed himself. No man of experience, upon hearing of the plans, believed them to be practical, and the more intimate the knowledge of the critics, the more were they convinced that this fantastic undertaking would meet with nothing less than failure. But these prophecies left out of the reckoning one thing, which alone action could bring to life, namely, Dohrn's iron will and his unusual abilities.

Within the limits I must set myself in this address, it is impossible to give a picture of the difficulties with which Dohrn had to contend during these years. When, as we dare hope, that which he has written of the drama of these early years at last reaches print, no zoologist will fail to read it. As one example only, we will cite an episode out of many similar ones which might be chosen. In the autumn of 1872, when the building was almost ready for the roof and Dohrn at the time was lingering in Berlin, in order to seek support for his undertaking in the Academy of Science, from the Prussian authorities and from the crown, he suddenly received from Naples a telegram to the effect that the municipal authorities had stopped the building because the height agreed to by contract had been exceeded. This was in truth the case. In consequence of an incorrect level, it became necessary to exceed the prescribed height by a couple of meters, unless the whole structure were to be reduced in size. This infraction of the agreement aroused anew the smouldering fires of suspicion. All the enemies and envious critics, all those whose profits had been interfered with, again rose, and soon the rumor was rife that the building must be razed to the ground. Dohrn hastened immediately to Naples. It was autumn and the season of the heaviest rainfall was imminent. Unless great damage were to be done, the house must at once be put under cover. But notwithstanding every effort, he was unable to obtain more from the municipal authorities than the permission to carry on the work at his own risk. A settlement of the question as to the height could not be reached. Not an instant did Dohrn pause to consider; the precious time must be used to advantage, and the work of building continued. He was also confronted with the problem how to procure funds to pay the indemnity occasioned by the slight excess of height. The straining of every nerve had to be begun again in order that those upon whose favor the success of his enterprise rested might be reconvinced and rewon. This work he had believed to be behind him. But all ears appeared closed. Week after week passed and nothing was attained. Still undisturbed and unaffected by the damage that a deluge of unusual and unprecedented severity had occasioned, he pushed his building operations towards completion. Suddenly a command came from the city authorities that the work must be definitely discontinued and, as if this were not enough, at the same time bad news arrived from Berlin. Du-Bois Raymond, in whom Dohrn had found a friend and sympathizer, wrote him that the circle of intellectuals in Berlin with whom rested the final decisions, were so unfavorably disposed that no aid from the academy and thus no subsidy from the German government could be counted upon. Du-Bois Raymond deeply regretted being obliged to communicate to him anything so adverse to his interests, and hoped that Dohrn would not allow himself to be cast down, but would make every effort to get the necessary help elsewhere. The evening of that same day Dohrn was on his way back to Berlin, and before Du-Bois Raymond could

expect even an answer to his letter Dohrn was before him in person. He begged his well-wisher to tell him what were the dangerous weapons which according to the letter would be directed against him. As Dohrn had suspected, it was, on the one hand, doubt as to his scientific abilities, by which means Professor Peters had prejudiced his Berlin colleagues against the undertaking, and, on the other hand, it was rumored that the Zoological Station was a commercial venture, and as such should not be subsidized by the government. As soon as Dohrn received this information he replied that he had determined nevertheless to get the money he needed in Berlin; and so, as in Naples, a similar personal campaign was carried on, but with better success. From one opposing academician he went to another and soon succeeded in disarming the most hostilely disposed; the others he convinced of the importance of the beginnings he had made, and of the correctness of the chosen ways and means. One of the amusing pronouncements let fall at this time by the veteran Ehrenberg may be cited here. Ehrenberg affirmed that if Dohrn attacked the fauna of Naples with such an armory of equipment and helpers, in five or ten years there would be nothing left there to investigate. This Berlin campaign lasted fourteen days, in which time he was also able to win to the cause a few more valuable patrons to aid in the further development of the station, and through them was enabled to reach the ear of the crown prince.

He next returned rapidly to Naples, where the opposition to his undertaking had reached the highest point. The German consul general received him with the information that he believed the day to be lost. Public opinion demanded the tearing down of the building. This rumor was verified at the office of the municipality. Every means to turn the tide seemed to have been exhausted. Dohrn's article entitled "The Present Position of Zoology and the Establishment of Zoological Stations" had just appeared (translated into Italian) in an important monthly, and this saved the day. This publication Dohrn sent to the most influential of the city authorities without indeed hoping much from it; but in one case at least the seed fell on good ground, namely, with Baron Savarese, at that time the powerful leader of the selectmen. He expressed a wish to make Dohrn's acquaintance and in a conversation that lasted for three hours Dohrn succeeded in winning over for his project this man who was as intelligent as capable, so that Savarese promised to carry the cause to victory in the municipal council despite its enemies. Ten days later he had made his promise good. Almost at the same time the news came from Berlin that the governmental subsidy for the next year was assured. And thus was taken the first step so immensely important for the continued success of the station, in its assurance of the repetition of the grants from the German and Italian governments. In this way were these two, perhaps the greatest crises in the history of the station, safely passed. Trying as were such times, they show us Dohrn in his element. He appeared as a general on the field of battle. Nothing discouraged, intimidated or turned him aside. In every situation he appeared the same; what others believed to be impossible his penetrating insight resolved into a number of difficulties, but all possible to overcome. No trouble was too great for him to take, no step too hard, no smallest possible opportunity was too insignificant for the forwarding of his plans. His letters went in all directions. He quailed before no journey, no matter how difficult. He attended congresses in order to inform

his professional associates of his hopes, and by means of fascinatingly written articles he instructed and interested the educated classes. He visited numberless people and imbued them with the same inspiration by means of his selfless enthusiasm, through his knowledge of the world, his eloquence of speech and power of repartee. Each new patron gained served as the point of approach to other connections, until he at last reached the place where decisive steps must be taken. With astonishing rapidity he familiarized himself with conditions previously foreign to his life. He was inexhaustible in thinking out new methods, but restless as was the working of his imagination and impulsive as was his character from childhood, he soon learned that unremitting self-control which permitted of no undue haste. He knew that situations change, he knew the mutability of public opinion, what human decisions mean, and that they none of them are unchangeable. Patiently he was able to wait, but like the eagle in the air, his eye was upon the object of his desire, and he swooped upon it as soon as it was attainable. And all these traits were held together and crowned by an unusual strength of mind, which, to quote Jacob Burchhart, "alone is able and therefore loves alone to sail through storm."

As you all know, the origin of the Zoological Station rests on two entirely original ideas of Dohrn's; one of which was to connect with the laboratories a public aquarium such as already existed in London, Hamburg and Berlin. His idea was that the income that these other aquaria were paying to the stockholders in this institution should be used for the benefit of science. Dohrn has said, and it has often been repeated, that this idea came to him on the fourth of January, 1870, as he rode in the mail coach from Apolda to Jena. "It came to me," so he writes, "like a revelation, and a limitless horizon of attainable results appeared to my feverishly working fancy." This fundamental idea demanded for its field of operation a large, much-visited city on a seacoast rich in fauna, and this determined the choice of Naples. As it was later shown that the admission to the aquarium would not suffice for the cost of current expenses, Dohrn fixed upon his second chief idea—to secure for the station an enlarged and stable income by renting out to governments and corporations tables for work. And it was chiefly this so-called "table" system which gave an international character to the station. The station is self-supporting, and both ideas have proved to be successful. The subsidies of the German and Italian governments pay for "tables." Dohrn realized, however, that in the beginning this would not be practicable. First of all a large capital had to be secured for the furnishing of the building; and this sum came mainly from Dohrn's father. In the address made by Dohrn in the spring of 1897, as the station was celebrating the twenty-fifth anniversary of the laying of the cornerstone, Dohrn spoke with loving expression of filial reverence, of all that he mentally and materially owed to his father; but one must not think that his father's help came to him without trouble or battling. No one was more firmly convinced than this very father that his son was following a Utopian scheme, was chasing a will-o'-the-wisp, sure to result in a pitiful fiasco. He not only firmly refused every appeal for aid, but a complete break which lasted a long time between these equally hard heads was the consequence. The quiet soothing influence of Dohrn's mother aided much in the solution of these differences of opinion. When the son had succeeded without his father's help, and the latter, against

his will, was forced to acknowledge that he had thoroughly misjudged the character and capabilities of his son; and when letters from Darwin, K. E. von Baer and other notices of the importance of the newly founded Zoological Station left no further room for doubt, only then did he grant the sum which Dohrn would later have inherited. Fortunately, for many years he was able to enjoy the ever-increasing success of this son.

In the year 1873, as the station was nearing completion, a picture was placed beside the other frescoes which adorned the walls in the hall later to become the library, but then planned as part of Dohrn's residence —a picture which as a document of the time will become more and more valuable as the years go on. The painting shows us five young men who had gathered together about Dohrn in Naples. The highly gifted and unusual Nikolas Kleinberg, chosen by his friend as director of the laboratory; next him the English poet and writer, Charles Grant, who, enthusiastically emersing himself in Neapolitan life, became the beloved interpreter for his friends of their new environment; Adolf Hildebrand, the sculptor, to whom the exterior elevation of the building suggested by Dohrn owes its artistic harmony, and in the background of the picture is Hans von Marees, the painter himself. To-day these frescoes attract to the Zoological Station the art connoisseur, almost as much as the biologist. Here we see these friends, joined a little later by the gifted Francis Balfour as in the ruins of Posilippo they sit together over a glass of wine at the end of a full day's work. On one such evening the exuberance of their joy in living found expression by their decision to swim to the Castell Dell'Ovo, a test of strength to which Dohrn alone proved equal. At last in February, 1874, the Zoological Station was ready for a formal opening, although already a number of investigators had commenced their work. Shortly after this Dohrn married Fräulein Marie von Branowska, the daughter of a friend who lived in Italy. She took a very prominent part in the fulfillment of his ideals. Four sons came from this union, the third of whom, Reinhart, is the successor of his father.

With the finishing of the building and aquaria, there commenced for Dohrn the only less difficult task of equipping the station and providing for its maintenance, so as to meet every possible demand of the investigators working there. At this period his broad view and talent for organization, the tact with which he held in check numberless small difficulties, his restless ambitions, are perhaps more worthy than ever of admiration. It was now necessary to attract young scientists as assistants to the new institution, to educate a personnel to carry on the routine and to establish a regular industry of fisheries. The numberless demands of the often inexperienced investigator had to be learned and satisfied. The habitat of the animals, the times of their appearance and of their maturity, had to be determined, not to mention many other details. This early period of the station presents a happy picture, over which now lies the enchantment lent by distance, blotting out some of the unpleasantnesses.

All was ceaseless activity, as at the advent of spring, and the work grew under the hand of its creator. Early experiences had shown that the station could not properly carry out its functions without a small steamer, and the *Johannes Müller* soon began its successful voyages. But now an imperfect knowledge of the fauna and flora of the bay made itself painfully felt, and in order to gradually remedy this defect Dohrn began the publication of "Fauna

and Flora''; to-day an imposing contribution of thirty-three volumes. The desire to have a medium for publishing the briefer records of observation conducted in the station, as well as to give this work publicity, led to the appearance of the *Mitteilungen*. The necessity of procuring for the library all the newest biological literature was the reason for the publication of the *Zoologischen Jahresbericht;* a model of its kind. Soon came countless demands for material for experiment and observation. This led to the development of a new technique for conserving specimens which were supplied to museums in many different countries. The specimens of the wonderful creatures of the sea were most life-like, and the microscopical technique of the Zoological Station was also greatly advanced. The rapidly appearing communications of investigators working there testified to the brilliant way in which the new institute fulfilled the object of its foundation. The head of the station saw without envy how the fruits of his creation even in his own special field of investigation were harvested by others, so numerous were the claims made upon his time from every side, and the greatness of his character is demonstrated by the unselfish way in which Dohrn regarded men of equal strength developing beside him. What he once had confided to well-tried hands, that he now allowed to grow in these same hands and become independent. One name rises to the lips of all here—Lo Bianco. In the porter's lodge of the house in which Dohrn then lived, he had often noticed a boy always usefully busy. Dohrn made use of the fourteen-year-old boy for every kind of small service at the station. In this environment the unusual and very gifted young man grew up to become one of the most important factors in the station, founding and brilliantly directing his own department. Suddenly this powerful figure whose presence can not be dissociated from the Zoological Station, the friend and helper of all working there, has vanished; struck down as by a thunderbolt.

Five years were given over by Dohrn almost entirely to the building and equipping of the Zoological Station. He looked with impatience for the moment when he could return to his own extensive investigations. It is not the wish of this assembly that the importance of Dohrn's scientific achievements should be touched upon in a valedictory; but if it were I, knowing so little of the particulars of Dohrn's special investigations, would refuse the task. As, however, the purpose is to present a character-sketch I can not refrain from attempting to give a picture of the man. When one asks what Dohrn could have meant when he said it was by accident he became a zoologist, I believe we must see in this an expression of the conscious feeling that he was not born a naturalist. The study of his scientific work leads to the conclusion that he did not lack any of the highest attributes of an investigator. He did not, however, possess the elementary desire, the wish, to make observations, to discover new facts known only to the investigator himself. He did not underestimate the value of discoveries, but he was almost indifferent about making them himself. Is it not remarkable that, having opened the shaft leading to the mine of the undiscovered, he did not decide to follow this path? External influences did not determine for him the direction of experiment, but to his own mind problems of a certain kind were presented in theories, which he then tried to prove by known facts. We see that the conceptions he had grasped while in Jena governed the direction of his thought to the end. In his scientific activity he showed himself to be

always the same, possessing a restless imagination which presented in anticipation that which he wished to see accomplished. This was bound up with a passionate energy in carrying out what he believed to be right. But these qualities had one effect, when it was a question of reaching a certain goal, and another, when a scientific problem was to be solved. The conception of creating a Zoological Station of the greatest value to science, and the idea that the esophagus of the ancestors of the vertebrates had first passed through the central nervous system, as mental concepts are perhaps not so very different; but in order that these thoughts should actually become productive of results they require elaboration and different attitudes of mind. In the first case a course of action must be followed. The actual achievement leads to the proposed goal. The question of which one is right or wrong has no significance in this connection, other than the idea as to whether the goal is or is not attainable. In the second case there is the question of proving that the course followed corresponds with the one pictured in the imagination. No road is to be made, but one and only one road is to be found. Nothing can stand in sharper contrast than the two ways of working as expressed in the often unrecognized differences between artistic, in its widest sense, and scientific ability. True, both can be found in equally able men, but even in the greatest it seems impossible for one quality to be combined with the other without loss. Dohrn was undoubtedly more a man of the first type. He was impelled to express something personal, as it were, an image of himself. In most expressive words he once described the Zoological Station as an organized work of art which he wished to create. Can such a man in the usual sense of the word be an investigator? Can he who so often found himself a controller of men and situations become a servant such as nature demands of those before whom she is to lay bare her secrets? Did it lie within the power of man to change annelids into vertebrates, possibly Dohrn had been the one to accomplish even this; but that is quite another question.

I wish to call attention to another quality which influenced his scientific productions, and to characterize this in his own words. He writes:

> Without doubt it was, and is a peculiarity of mine to take up a new idea with an apparent partisan blindness. This conception might appear to others absolutely questionable. My lively powers of imagination and the accompanying need of expressing and giving them play might all too easily produce the impression that I looked neither to the right nor to the left, but as it were, hypnotically controlled, saw only in one direction—before me. But in fact this is not the case, thoughtless as I appear, and carelessly as I may express myself, just so easy is it for me, once this craving for expression is satisfied, and the one-sided conception is followed to its utmost limits, to turn about and to follow in an almost diametrically opposite direction, and, if possible, going even further in overthrowing the first conception than my critics.

These words refer to questions of practical usefulness, and I cite them in order to give an example of the self-analysis used by Dohrn. Does not he who knows Dohrn's work read in it the same characteristics? Is not the irrepressible need for expression which must relieve his intellectual tension revealed by writing, before the carefully weighed deliberation upon the other side can come to expression? But notwithstanding the obvious faults connected with his scientific work, the undeniably great personality of the man must be recognized. Dohrn had none of that pride which wishes to write its name in as many as possible of nature's books; his mind was concentrated on one ideal.

Seldom is the scientific life work of a scholar revealed to us so clearly and divided into periods so dominated by motives as that of Dohrn's The beginning is composed of systematic entomological work, inspired by the father's occupations. Arthropods were, therefore, especially well understood by him. Naturally, as a result of Darwin's influence, a change took place in his scientific thought, and he at once applied to the arthropods his phylogenetic theories. In the monograph on pantopoda, published in 1881, the second period terminates. This work proves the fact that through his colossal undertaking, "Fauna and Flora," Dohrn wished to set a good example in a field that was hardly sympathetic to him at the time. Meanwhile he had reached out to grapple with the most important genealogical problem, viz., that of the origin of vertebrates. As early as 1875 in the much-noticed publication, "The Origin of Vertebrates and the Principle of Functional Change," he had outlined the proposed work. And now followed, with the same end in view, "The Studies upon the Origin of the Vertebrate Body," with which Dohrn's twenty-fifth publication came to a close in 1907; before even the greatest part of the mass of introductory work had been completed.

In all these works he is heart and soul historian. Good-humoredly conversing with Momsen, who at first was not favorably disposed to him, Dohrn affirmed that as a matter of fact fundamentally they were working at the same problems. For the zoologist, he maintained, carries on archeological historical studies, but in epochs much more remote than those of so-called ancient history. Again and again in his writings he makes such comparisons as these. The study of man was in reality covered in his studies of vertebrates. His aim was not to erect family trees, but to get an understanding of their growth. No biological law could, in his opinion, have taken the place of genetic observations. He humorously compared the phylogenetic stages with the ancestral picture gallery of a royal castle. To him the epochs were also comparable with the technical models in a museum showing all steps in the development of a steam engine or dynamo. He was convinced, in fine, that both developments—the phylogeny of man and the history of man—must go back to one basic principle. This he believed, even though at the time he had not advanced beyond certain indefinite premonitions. Characteristic of this is his well-known preference for ontogeny in arriving at phylogenetic conclusions as contrasted with comparative anatomy. He was even convinced that he could correctly explain the significance of specific cases and many a heated battle was waged over these opinions. To-day we may allow these debatable questions to lie quiet, for whether or not we grant Dohrn's theoretical standpoint, a saying of Liebig's is justly applicable to him. "One who works is sure to make discoveries, no matter where he starts." What may have appeared to the author, in his effort to reach the ideal, as possibly only his working materials—the great quantity of facts that he brought to light by his untiring application, and the greater improvement of his methods—gave him an honored position among the students of animal morphology; especially in the most difficult of all fields, namely, that dealing with the genesis of the vertebrate head.

Most of Dohrn's publications possess, aside from their subject matter, great literary charm. If we divide, as does Wilhelm Ostwald, investigators into classicists and romanticists, it will be seen from what has already been said that Dohrn was markedly representative of the romanticist

type. His works are hardly less expressions of his feelings than of his understanding. He does not present in the least objectively his results, but he lets the reader follow step by step his mental processes to the extent that we see reflected in his works with absolute accuracy the intellectual highly cultivated man keen for battle.

There is no doubt that there were times in which Dohrn estimated his scientific activities as far outweighing in value what he had done for biology through the founding of the station. In such moments he treated the criticism of his scientific opinions with rough injustice, but in this he had the precedent of such great predecessors that it is sufficient to mention the fact only in order to avoid an exaggerated attempt to enhance his character; an effort Dohrn himself would have deprecated. To-day when the sound of battle has passed, those who have run counter to him most sharply acknowledge not alone his great love of truth, but accept the fact that those great outbreaks of a passionate temperament were only the shadow-side of a nature which must have been as it was in order to produce along other lines unequaled and imperishable work.

When one sees how directly and without deviation Dohrn followed his own scientific course, the comprehension he showed of all other branches of biology is doubly remarkable. That he should welcome to the station those engaged in all lines of biological work was a part of the nature of the undertaking. Dohrn had an unusually clear insight into the various fields of our science and of the manner in which they were interdependent and yet complementary to one another. Perhaps the most surprising thing about this apparently one-sided morphologist was the large space dedicated by him to the department of physiology. The addition to the first structure opened in 1888 was planned in order to secure more space for this department and the last great extension, a second time doubling the size of the original building, was put by Dohrn almost exclusively at the disposal of physiologists. This new edifice makes the modest older sister laboratory appear almost in the nature of a step-child. He did not have in mind that physiology for which so much is promised in all modern text-books. Physiology is the knowledge of the vital processes and is divided into physio-physics and physio-chemistry. Before his eyes was a physiology as comprehensive as that conceived of by Johannes Müller, and of which Naegeli once said: "In its Holiest of Holies belongs the origin of the organic world." The time that has elapsed since the founding of the great physiological department is still too short to pass judgment upon the results of this attempt to make physiology breathe sea air. Still even now it can be seen that the close contact which Dohrn established between the study of animal life and development and the exact methods of physiology has stimulated all. His capacity to see, beyond his own field of work and his temporary favorite opinions, the real problem of what life represents and to approach this question from different sides filled the station with a spirit free from all pettiness.

Dohrn was an incomparable host to all his guests. How pleasant it was to meet with him in the library, to pass an evening at his house, or better yet, to sail out with him upon the bay to Cape Misenum or Capri or to his well-beloved Ischia. It was a pleasure to see this man in happy communion with nature, to chat with him seriously, or jokingly, to listen to him as he talked. Of him it can truly be said that nothing human was foreign to his interests, thanks to an almost fabulous wealth of ex-

periences stored up in his ever-impressionable soul. He inherited from his father the love and fine appreciation of music; which was dearest to him of all the arts. Once when an intimate colleague said to him that had he means he would found a picture gallery, Dohrn replied, "And I would own an orchestra led by the best of conductors." While a young man the chance whistling of an air from a violin concerto of Mendelssohn, who, by the way, was his god-father, won for him the sympathy, and later the almost irreplaceable help, of Lloyd, the English aquarium expert; and in later years the road to his heart was most easily found by those with whom he could commune through a common musical taste.

It were vain even to wish to describe the powers of attraction exerted by Dohrn over individuals of widely differing personalities. To the test, "Tell me with whom you associate, and I will tell you who you are," Dohrn could confidently have submitted himself. When, in 1902, an intimate friend among foreign zoologists traveling through Germany, asked a German colleague if he often saw Dohrn, the reply was: "We never see Dohrn any more, he associates entirely now with princes, excellencies and millionaires." In this joking exaggeration is hidden a real and at the same time an important side of Dohrn's relations with people, important alike for the station and zoologists. When he began the building of his zoological station and knocked now here, now there at the doors of the well-to-do, asking if they were not inclined to make some offering in the interests of science, he found, with few exceptions, wise councils, but no money. One notable exception was a gift from English scientists led by Darwin, Lyell, Huxley and Lubbock. Nothing better illustrates the position he finally won for himself than the fact that thirty years later not only did the city of Naples again cede to him a most valuable piece of the public garden, for the station's new building, but above all he erected this building with funds placed at his disposal without conditions by rich friends. And so great was the consideration and confidence he enjoyed that without the least difficulty he could have obtained even greater sums, without specifying "the why or wherefore." But at first, as we have already said, his requests for aid brought only disappointment, and it would have gone hard with the station had not the personal impression he so well knew how to make on ministers and ambassadors and leading members of the Berlin Academy and the Reichstag led to a spirit of readiness to grant support; an accomplishment which compels us to marvel when we consider the caution and the typical reaction of inertia such appeals usually evoke. But quite as necessary as material means for the success of this undertaking planned by a German on Italian soil, was the awakening of an Italian sentiment and the moral support of the fatherland. Highly as we may estimate the spontaneous interest in zoology of the German and Italian rulers, it is beyond question that this sympathetic interest was stimulated by Dohrn's personal qualities and by the turn that his creative faculty could give to the methods for carrying on zoological investigations. The gain to the station coming from this powerful protection needs no comment.

When I spoke of Dohrn's social affiliations I had something special in mind: From his earliest years until his death he maintained the closest ties of friendship with men of the highest intellectual standing entirely regardless of material conditions. I mention only those who are dead, and whose names are widely known: one of the most notable zoologists, Thomas H. Huxley; the eminent physicist and founder

of the Zeiss works, Ernst Abbé; the gifted inventor, Werner von Siemens; Robert von Keudell, ambassador, distinguished in mind as in character; the great musician, Joseph Joachim; and the painter, Hans von Mareés, who at last, after long neglect, is receiving recognition, are enough to prove to us what a noble and rich nature Dohrn must have had. Without these mental qualities would it have been conceivable that he could have won and kept for the station such remarkable professional associates at a time when the future of his creation and of these young men was still unknown? And this attachment of his fellow workers is so much the more remarkable as there were times when the attempt to work with Dohrn was no easy task; but even then the essential element of Dohrn's nature shone out through the mist, so that even the simple fisher-folk were able to appreciate it. Underneath the overbearing character of a nature born to command they were able to recognize a kindly personality in whose hands they knew themselves to be secure. With faithful devotion they hung upon their "Signor Dohrn," and whatever he might have demanded of them each and all would have obeyed.

Fragmentary as is the picture, it were incomplete in a most important point should a subject I have just touched upon remain unexpressed; namely, that the shadow-side as well was not lacking in this wonderfully successful life. Already in the beginning of the early seventies the periods of his greatest development of strength were broken by times of such deep nervous depression that all the remarkable qualities which distinguished Dohrn on other days then seemed almost to disappear. He himself attributed the origin of this affliction to his mother's family, but the indescribable fatigues and condition of mental tension under which he lived were sufficient to explain the occurrence even in a very strong constitution, of these periods of complete exhaustion. Much as he enjoyed his life in a foreign land, this exile brought a great deal that was painful. Dohrn's was one of those natures which, while fully conscious of their achievement, look upon that which is finished almost as the work of another, and hence again and again feel impelled to prove their right to live by new deeds accomplished. Thus the latter years of his life were almost a continual torment to this man of action, for his bodily strength could not keep pace with the still active spirit. Yearly, physicians sent the rebellious man northward, over the Alps, for months at a time. And like Albrecht Dürer, who after only a short journey in Italy sighed at parting, "wie wird mich nach der Sonnen frieren; hier bin ich ein Herr, daheim Schmarotzer," so exclaimed Dohrn as he left his life-work behind him.

To linger awhile in the world of his own creation, and to sail once again in his well-beloved boat out upon the blue waters, was his last wish; but before it could be realized, he died suddenly in Munich on the twenty-sixth of September, 1911.

When I undertook the task of speaking to you of Dohrn, I asked myself which one of his qualities was it above all others that gave birth to the wish to honor his memory before an International Zoological Congress. Scientific achievement alone, as far as I know, has never prompted such an honor. If one should say in Dohrn's case it was the influence exerted on collective achievements, the instance might be paralleled by Abbe's improvements on the microscope. Those, although in a different way, were not less far-reaching in their effect on the development of biology, but as a result of this accomplishment it does not follow that a congress of zoologists should

feel prompted to recognize publicly such great services. The answer, I believe, is not hard to find. We honor in Anton Dohrn not only his prodigious achievements, but his marvelous insight that affects us so directly as zoologists. The zoological station was planned and carried on with the comprehensive realization of the importance of that place in the development of our science which it would be called upon to fill. And the more intimately we are acquainted with the early years of its history, the clearer does it become that for such a work a man was necessary in whom special and unusual qualities were combined; sometimes even partially contradictory ones. We feel the unprecedented and peculiar fitness of this personality for the work. As the man who accomplished this achievement undertook it in the service of a great cause, perfectly conscious that he must risk time, strength and health, yes all he had and all he held most dear—his figure takes on for us something of the great and heroic. But even in these immaterial things we find a law of compensation. Whatever a great man by untiring and unselfish devotion puts into his work as the result of the love of his profession, that is reflected in the labor itself. That which Anton Dohrn, impelled by the noblest of creative impulses, has done for all of us now compels us to honor him by an expression of admiration and gratitude that will hallow his memory through many years to come.

No more suitable occasion to express this could offer than the International Congress. In recent years it would hardly be possible to find a man more entitled to be considered as an international personality, and it is not necessary to explain more fully than has been done the peculiar applicability of this term to Dohrn. Those who knew him realize that he neither could nor would deny the race from which he sprung. He had a deep love of his country and he cherished a feeling of loyalty, thankfulness and duty to the land in which his being, physical and spiritual, had its roots. An excessive national pride or conceit was entirely foreign to him. The dispassionate impartiality with which in quieter moments he was able to analyze himself enabled him to compare the defects and advantages of his own with other nations. He was able, as many were not, to sympathize with the feelings of others for their own country. He not only understood, but enjoyed the traits of Italians, as well as of the English and Americans. He understood how to learn something from all, and to many he was bound by ties of intimate friendship; and when it was a question of science only, then all barriers disappeared. Was it not from beginning to end his dominant desire to realize in the Zoological Station not only one of the most favorably conditioned places for work, for all biologists, but above all to create a common center in which the one-sidedness of isolated scientific work could be equalized? How often has he said that the station represented, as it were, a continuous zoological congress. Every one who has worked long or often in Naples must have felt this. Not only have numberless acquaintances and friendships arisen between the investigators of different countries, not only has there been an interchange of views, a discussion of work and of methods, but almost all who have worked in the station have consciously or unconsciously left behind them parting gifts from their scientific possessions which, gradually growing to a store of incalculable value, are put at the disposal of all those who follow and thus insensibly aid in the

ever widening and increasing usefulness of the station.

Of all the many inspirations of Dohrn, undoubtedly one of the happiest was the subsidizing of the station by the introduction of his table-system, thus making the institution international. Only in this way was it possible to keep the organism free from the dry husks of state tutelage, and to give it sufficient flexibility to meet new conditions, at the same time protecting it from the inertia springing from self-satisfaction or the possibility of retrogression by the ever-recurring necessity for meeting these needs.

But we must also take into consideration the reverse side of such fully adjusted reactionary capacities: its vulnerability. And here is the point at which our passive feeling of gratitude can be changed into active assistance. Every biologist, convinced that the Naples station, on account of its position and size, its catholicity of spirit and richness in opportunities for work, and, not least of all, because of its international character, is of inestimable value for our science, may, by openly giving expression to this belief, help to perpetuate the work as planned by its founder. Let us look upon this institution as a legacy from Dohrn which he has confided to the care of each one of us.

Even though we must grant that such a valedictory as this fails in its chief aim, as he in whose honor it is pronounced can not hear it, we must console ourselves with the thought that the men among whom Dohrn lived had not left him in doubt as to the esteem in which they held his work. Few men in our profession have been recipients of such honors as were shown him by princes and governments, by academies and faculties, from the city in which he worked, and from biologists all over the world, as were shown him during the station's jubilee celebration. Even more precious may have been to him the many spontaneous expressions of sincere admiration and grateful devotion. At the last International Congress such marks of appreciation were shown as to move him deeply, and even without all this he had only to reflect to become conscious of the fact that he had given an impulse to biology which could be equaled only by very few, and that his deeds and his name would continue to shine in the history of our science far above, where only the highest summits are visible. We zoologists will take pleasure in the thought that Anton Dohrn belonged to us.

Theodor Boveri
University of Wurzburg

THE SCIENTIFIC WORK OF MISS N. M. STEVENS

Miss Stevens began her career as an investigator in 1901 at the age of forty years. It is rare for one who starts so late in life to attain in a few years so high a rank amongst the leaders in one's chosen field. In Miss Stevens's case this was made possible by her natural ability and devotion to her work, as well as by the liberality of Bryn Mawr College, which created for her a research professorship. Her investigations lay almost entirely in the field of cytology, and covered not only extensive studies of the germ cells, but a memoir on the life cycle of one of the protozoa, and several papers on the histology of regenerative processes in planarians and hydroids.

Modern cytological work involves an intricacy of detail, the significance of which can be appreciated by the specialist alone; but Miss Stevens had a share in a discovery of importance, and her name will be remembered for this, when the minutiæ of detailed investigations that she carried out have become incorporated in the general body of the subject. In 1906 she found that the male of a beetle (*Tenebrio molitor*) produced two kinds of

sperm, differing in that one half the sperms have a large chromosome and the other half a smaller chromosome. Two such classes of sperm were already known in certain other insects, and McClung had earlier suggested their connection with sex production. Miss Stevens was among the first to establish the correctness of this hypothesis by the discovery that the small chromosome is confined to the male line while in the female its place is taken by the larger one. She drew the correct inference that since all unfertilized eggs are alike in their chromosomal content, therefore a female results from the fertilization of an egg by the sperm containing the larger chromosome, and the male by the sperm containing the smaller chromosome. A similar relation was discovered at the same time by Professor E. B. Wilson. Their joint discovery marks the turning point in the history of the theory of sex-determination.

During the following six years Miss Stevens extended her studies in this subject over a wide field. In 50 species of beetle she found an unpaired chromosome in twelve cases, and an XY pair in thirty-eight cases, and in nine species of flies she found an XY pair of chromosomes. Such an extensive study will not seem superfluous when the reception of this important discovery in regard to sex is remembered, for the profound significance of the results were by no means generally appreciated, and it is not going too far to say that many cytologists assumed a sceptical or even antagonistic attitude for several years towards the new discovery. No doubt this will be attributed to scientific caution, but conservatism may better account for the slowness with which a recognition of this discovery was received. It was said, for example, that the unequal distribution of the sex chromosomes is only an index of some more profound changes taking place, and is not in itself the real differential. In apparent support of this objection was advanced the fact—which Miss Stevens's work had also helped to establish—that in a number of insects the sex-chromosomes are equal in size. The first objection is purely formal, for even if true the discovery would still remain of prime importance as indicating when and how an internal difference arises that leads to the formation of the two sexes. In regard to the fact appealed to in apparent support of this objection, it has, more recently, become apparent that the sex chromosomes are also responsible for a number of other differences, in addition to that of sex determination. In other words, sex determination is only one of many "factors" carried by these chromosomes. If this is granted, the inequality in size differences—one on which perhaps too much emphasis was placed at first—is in itself of no significance, although when such a difference is present it gives a clue to a fundamental relation which might otherwise escape detection. The appeal, therefore, to the cases where no difference in size can be detected, has no significance, except in so far as an unfortunate emphasis laid on a size difference gave the conservative-minded an opportunity to insist on an unimportant criticism.

Miss Stevens's first paper in 1901 gave a complete account of the life cycle of the protozoan, *Boveria*, parasitic in Holothurians. Later she discovered the occurrence of true chromosomes in this form, and made out many of the processes that take place during conjugation.

Four papers dealing with the chromosomes in the life cycle of Aphids appeared in 1905, 1908, 1909 and 1910. The double number of paired chromosomes was found in the parthenogenetic cycle, and the reduced number in the sexual forms. The parthenogenetic eggs were shown to give off a single polar body; the sexual egg two polar bodies. Miss Stevens denied at first the presence of an unpaired sex chromosome in the spermatogenesis, but later corrected this error. She failed to note, at first, that the male had fewer chromosomes than the female, but later recognized this difference. In her work on other insects she described both an end-to-end union of chromosomes, as well as a side-to-side pairing, but her work on the synaptic stages was far less complete and convincing than that on other parts of the germ-cycle. At the time of

her death she was engaged in studies directed more especially to this difficult phase of gametogenesis.

She discovered in the Muscidæ that the homologous chromosomes lie side by side in each spermatogonial and oogonial division, as well as before synapsis. Even in somatic division a similar pairing was found. In *Ceuthophilus* one to three supernumerary chromosomes were discovered, whose behavior in rest and in growth stages indicated, she thought, their probable relationship to the sex chromosomes (1912). Previously, she has found that the presence of supernumerary chromosomes in *Diabrotica* led to a variable number (with fixed limits however) of chromosomes in different individuals of the same species.

In the regenerative processes in the hydroid, *Tubularia,* Miss Stevens found that the old tissues become remodeled into the new without undergoing any retrogressive changes, and a similar condition was found in Planarians. In *Sagitta* the true oviduct, previously overlooked, was described and its development, and that of the ovary also, were thoroughly studied.

Some interesting facts in regard to the color of the parthenogenetic and sexual forms of Aphids were recorded, but the study of the inheritance of these colors was not brought to completion, although certain possibilities were indicated. Miss Stevens's experimental work was much less extensive. It included studies on the regeneration of hydroids and planarians. She performed the delicate operation of separating the centrosome from the rest of the karyokinetic figure with the eggs of the sea-urchin. The non-nucleated piece, with a centrosome but without a nucleus, was found not to divide further, confirming Boveri's conclusion that the centrosome alone is unable to bring about cell division.

Miss Stevens's work is characterized by its precision, and by a caution that seldom ventures far from the immediate observation. Her contributions are models of brevity—a brevity amounting at times almost to meagerness. Empirically productive, philosophically she was careful to a degree that makes her work appear at times wanting in that sort of inspiration that utilizes the plain fact of discovery for wider vision. She was a trained expert in the modern sense—in the sense in which biology has ceased to be a playground for the amateur and a plaything for the mystic. Her single-mindedness and devotion, combined with keen powers of observation; her thoughfulness and patience, united to a well-balanced judgment, accounts, in part, for her remarkable accomplishment.

T. H. Morgan

THE SCHOOL OF JOURNALISM OF COLUMBIA UNIVERSITY

Talcott Williams, director of the School of Journalism in Columbia University on the Pulitzer Foundation at the formal opening of the school at Earl Hall, September 30, spoke in substance as follows:

The School of Journalism opens, within a year of the death of Joseph Pulitzer whose endowment rendered this training for the newspaper man possible, with about a hundred students. They represent 21 countries and states, including China and New Zealand. Less than half are from New York state. In the first year one half are men who have had newspaper experience and all these left wage-earning positions to enter the school. One fifth of those in the school hold college degrees, a proportion far larger than when law and medical schools first opened. Of the 100 pupils entering, nine are women, a proportion of women less than that which exists in journalism, taking all newspapers and periodicals. Of the teaching force, 24 in number, 8 or one third have had practical experience in journalism and four have given nearly all their active lives to this calling.

In America great changes are worked by wide discussion. The first fruits of the school are that before it opened, the newspaper discussion for six months past, jointly due to its great endowment and the action of Columbia University in accepting it, had proved public conviction of the need of training for newspaper men and the demand and

support of the newspaper press, as a whole, for this professional preparation. This public verdict has quickened the interest, both of the public and the universities in this field. The question is no longer, as it was half a year ago, whether journalists shall be trained, but how they shall be trained so as to become efficient journalists better able to serve the public.

Under the foundation men of experience, ability and maturity are admitted to the school without an examination and after two years of adequate work are eligible to the degree offered by the university on the completion of the course. This opportunity to gain a college degree without the usual requirements for matriculation has attracted a large number of applicants, but they have been rigorously sifted, none accepted unless they showed a special capacity for journalism, and 17 have been admitted.

The training of the School of Journalism in Columbia University through its four years' course divides itself between studies on history, law, government, party organization, economics, unions, trusts and literature, training in reporting and training in writing. The first two years are devoted to the fundamental studies whose knowledge is necessary to the journalist in his work. Men intending to be journalists who have not had a college education are strongly advised to take these two years, if they are unable to take the full course. They are crowded with the studies which will aid a man's future work in journalism. These studies are immediate and deal with the issues and events of to-day. The entire course is made up after consultation with and the approval of a group of the ablest journalists in the country.

Nearly one third of the time in the course is given to training in writing. The students will do nearly as much writing each week as the average man in a newspaper office. This work will be rigorously corrected and required to be punctual as on a newspaper and will be done under a time limit, as in service condition. Training in writing in the school looks to accuracy, presentation and a vivid style. In this training, the customary place in college "English" of "themes" and subjects, created for the occasion, is laid aside and the subjects on which men write spring either from their studies or from their work as reporters. Political science at the opening of the present year, in the first-year class, is devoted to the presidential election. In the second year, economics will be studied in the usual beginning course; but weekly, the pupils will write under direction a "business article" reviewing the business and financial week, such as many newspapers publish Saturday, Sunday or Monday. History will furnish subjects cast in newspaper form in the shape of despatches from historic battlefields, reports of historic events and estimates of public men and measures, treated in the editorial spirit. Throughout all the studies this plan will be adopted and both science and literature will be used to supply subjects training men in treatment and presentation.

The news of New York will be employed in the last two years to train men in reporting, to school them in writing and to acquaint them with the life of a great city. Trials, the visit of the battleships, the election, where the returns will be handled, large events and small will be used as assignments. The manifold copy ("tissue") furnished newspapers will be employed in editing copy and in building head lines. The presidential campaign will furnish a text for editorial writing, new plays will be the subject of notices, the exhibition of the Academy of Design of art criticism and new books of book reviewing.

When the women who have now entered for the first year reach the third and fourth year in this course, those who desire to prepare for the woman's page will be given the opportunity in connection with the School of Household Arts in Columbia University. Already students in the fourth year in the school are selecting studies in sociology intended to lead to special fields of writing, but of all students reporting is required, as the basis of the newspaper man's training.

This combination of exact study in the structure of the state and its action in his-

tory, administration, party organization and economics, combined with accurate reporting and graphic writing has not yet been attempted on the same scale and under such favorable conditions. It is planned by newspaper men, it is taught by newspaper men, and it reproduces newspaper conditions in order to train the newspaper man.

BRITISH ASSOCIATION GRANTS FOR RESEARCH

At the Dundee meeting of the British Association grants for research amounting to over $5,000 were made as follows:

Professor H. H. Turner, seismological observations, £60; Dr. W. N. Shaw, upper atmosphere, £50; Sir W. Ramsay, grant to the International Commission on Physical and Chemical Constants, £40; Professor M. J. M. Hill, tabulation of Bessel functions, £30; Dr. W. H. Perkin, study of hydro-aromatic substances, £20; Professor H. E. Armstrong, dynamic isomerism, £30; Professor F. S. Kipping, transformation of aromatic nitroamines, £20; A. D. Hall, plant enzymes, £30; R. H. Tiddeman, erratic blocks, £5; Professor W. W. Watts, igneous and associated sedimentary rocks of Glensaul, £10; Professor P. F. Kendall, list of characteristic fossils, £5; Dr. J. Horne, Old Red Sandstone of Dura Den, £75; Dr. A. Strachan, Ramsay Island, Pembroke, £10; Professor Grenville Cole, Old Red Sandstone of Kiltorcan, £15; Professor S. J. Hickson, table at the Zoological Station at Naples, £30; Dr. A. E. Shipley, Belmullet Whaling Station, £15; Dr. Chalmers Mitchell, nomenclator animalium genera et subgenera, £100; Sir W. H. Preece, gaseous explosions, £80; Dr. R. Munro, Glastonbury Lake Village, £5; C. H. Read, age of stone circles, £2; Dr. R. Munro, artificial islands in Highland lochs, £5; Professor G. Elliot Smith, physical character of ancient Egyptians, £34; Professor A. Thomson, anthropometric investigations in British Isles, £5; Professor W. Ridgeway, Roman sites in Britain, £15; Professor W. Ridgeway, excavations in Macedonia, £30; E. S. Hartland, Hausa manuscripts, £20; Professor E. A. Schäfer, the ductless glands, £40; Professor S. J. Hickson, table at the Zoological Station at Naples, £20; Professor J. S. Macdonald, calorimetric observations, £45; Professor Starling, oxyhemoglobin, £15; Professor F. Gotch, mammalian heart, £20; Dr. D. H. Scott, structure of fossil plants, £15; Professor A. C. Seward, Jurassic flora of Yorkshire, £15; Professor F. Keeble, flora of peat of Kennet Valley, £15; A. G. Tansley, vegetation of Ditcham Park, £45; Professor J. J. Findlay, mental and physical factors, £20; Dr. G. A. Auden, influence of school books on eyesight, £15; Sir H. Miers, scholarships, etc., held by university students, £5.

SCIENTIFIC NOTES AND NEWS

Dr. Lewis Boss, director of the Dudley Observatory, Albany, since 1875, and director of the department of meridian astronomy of the Carnegie Institution, died on October 5, aged sixty-six years.

Professor Morris Loeb, the distinguished chemist of New York City, died on October 8, aged forty-nine years.

The Huxley Lecture will be delivered at Charing Cross Hospital Medical College on October 31 by Dr. Simon Flexner, of the New York Rockefeller Institute. The subject he has chosen is "Recent Advances in Science in Relation to Practical Medicine." Previous lecturers have been Professor Virchow, Lord Lister, Professor Welch, Professor Pavlov, Sir Patrick Manson, Sir William Macewen and Dr. F. W. Mott.

Professor Mary W. Whitney, director of the Vassar College Observatory since 1888, retires on a pension of the Carnegie Foundation as professor emeritus of astronomy.

Professor H. J. Wheeler, former acting president of the Rhode Island State College, at Kingston, R. I., and for eleven years director of the government agricultural experiment station at that institution, has tendered his resignation.

Dr. M. W. Haskell, professor of mathematics in the University of California, has received a half-year's leave of absence, which he is spending abroad.

Dr. David H. Tennent, professor of biology at Bryn Mawr College, has returned after a year's leave of absence spent partly in the Bahama Islands and partly at Naples.

Dr. Frederick H. Getman, associate in physical chemistry at Bryn Mawr College, has

been granted a leave of absence for the academic year.

PROFESSOR SANTAYANA, having resigned from his chair at Harvard University, and Professor Royce being on leave of absence for the whole year and Professor Palmer for the second half, there will be no full professor in service on the side of pure philosophy. Professor Bakewell, of Yale University, will come up from New Haven to give instruction during part of each week.

DR. NEIL E. STEVENS, recently assistant pathologist in the Kansas Experiment Station, has accepted a position as forest pathologist in the Bureau of Plant Industry.

PROFESSOR RUDOLPH EUCKEN, of the University of Jena, visiting professor at Harvard University, has been selected to deliver the Deems lectures at New York University this year. They will be six in number, and will be given in the English language, probably in February or March of next year. The subject of the course will be "The Fundamental Principles of Ethics with special Consideration of the Religious Problems."

PROFESSOR MORRIS JASTROW, of the University of Pennsylvania, has been appointed Haskell lecturer on oriental literature in Oberlin College.

AMONG public lectures being given at the University College, London, are the following: Professor Flinders Petrie, on "Amulets"; Professor G. Dawes Hicks, on "The Philosophy of Shadworth Hodgson"; Mr. D. Jones, on "General Phonetics"; Mr. Carveth Read, on "An Introduction to Comparative Psychology"; Professor H. E. Butler, on "Roman Education"; Professor F. W. Oliver, on "Joseph Dalton Hooker," and Professor J. A. Fleming, on "The Sources of Energy Available to Man."

A MEMORIAL to Lord Lister is to be established at University College Hospital. It was in 1843 that Joseph Lister entered the college as an arts student and graduated bachelor of arts in 1847. He then became a student of medicine and entered the hospital to complete his studies. A special committee has been formed under the presidency of the Duke of Bedford, president of the hospital. The exact nature of the tribute will be largely decided by the amount of the subscriptions received, but it has been suggested that either a bust or a tablet should be placed in both the hospital and the college. It is understood that the memorial will be entirely local in character, and only those who have been in some way connected with University College or the hospital are being asked to subscribe.

A TABLET in memory of Dr. Walter Reed, eminent for his work in yellow fever, will be erected at the University of Virginia by the Virginia Medical Association.

NAVAL constructor John Forsyth Hanscom, U. S. N., retired, an authority on naval construction, died on September 30, aged seventy years.

A REUTER telegram from London (Ontario) states that Mr. Stewart Dickey, of Belfast, Ireland, who recently arrived there to take up the position of professor of anatomy at the Western Medical College, has died in circumstances pointing to suicide.

MR. G. H. GROSVENOR, an entomologist connected with Jesus College, Oxford, who was assistant secretary of the recent International Entomological Congress, has been drowned off the Cornish coast in trying to save the life of a poor swimmer.

THE fifth annual meeting of the American Institute of Chemical Engineers will be held in Detroit, Mich., from December 4 to 6, 1912. A number of the technical plants in and about Detroit will be visited and a program of papers and addresses will be presented.

AT the eighty-fourth meeting of the German Association of Scientific men and Physicians held recently at Münster, it was decided that next year the meeting will be held at Vienna, under the presidency of Professor H. H. Meyer.

THE first Italian Congress on the history of medicine and natural science will be held in Rome from October 11 to 14.

Two of the commissions appointed by the official standing committee of the International Meteorological Association have been in joint conference this week at the Meteorological Office, London, under the chairmanship of the president of the committee, Dr. W. N. Shaw. They have discussed the questions of securing uniformity of practise in storm signalling, and of revision of the telegraphic code for the interchange of information.

Dr. Alfred Ackermann, of the publishing house of B. G. Teubner, has presented the sum of 20,000 Marks to the University of Leipzig, to establish the "Alfred Ackermann-Teubner memorial prize for the promotion of the mathematical sciences."

The Nantucket Maria Mitchell Association offers an astronomical fellowship of one thousand dollars, to a woman, for the year beginning June 15, 1913, under the following conditions: The year shall be divided into two periods, approximately as follows: June fifteenth to December fifteenth on Nantucket. This period shall be occupied in observation, research or study, and in lectures or instruction to classes or individuals. February first to June fifteenth at one of the larger observatories. This semester shall be occupied in original research and study. During this period a distinct plan for the following Nantucket period shall be formulated. Every fourth year the fellowship shall be available during the entire year for study at a larger observatory. The fellowship will be awarded annually, but in order that the work at Nantucket may be combined advantageously with the work at the selected observatory, the preference will be given to the same candidate for three successive years. This candidate shall have first consideration among applicants for the special quadrennial appointment. A competitive examination will not be held. The candidate must present evidence of qualifications. The Nantucket Observatory is equipped with a five-inch Alvan Clark telescope and a micrometer for measuring stellar spectra. The Astronomical Fellowship Committee proposes to add such equipment as will enable the fellow to make a special study of asteroids. The proposed plan has been approved by Dr. Edward C. Pickering and Miss Annie J. Cannon, of Harvard Observatory, and will be carried out as soon as practicable. Application for the year beginning June 15, 1913, should be made under the above heads, and must be in the hands of the secretary of the committee, Mrs. Charles S. Hinchman, 3635 Chestnut Street, Philadelphia, Pa., on or before March 1, 1913.

A letter received at the Harvard College Observatory from Professor E. E. Barnard, of the Yerkes Observatory, states that the spectrum of Gale's comet obtained by Mr. J. A. Parkhurst with the objective prism on the UV Zeiss camera, September 30, 1912, 7 P.M., shows only two bands: the fourth carbon band at λ 4711 and the third cyanogen band at λ 3883. The continuous spectrum was weak. There was a slight indication of strengthening at a greater wave-length than 4711, but the exposure was necessarily short, and nothing definite in this region could be seen. Exposures with the Bruce photographic telescope on September 29 and 30 show a faint, slender tail, 4° long. Though bright in a 5-inch telescope, the comet was not visible to the naked eye. The comet was also seen by Mr. E. L. Forsyth at Needles, Cal., on September 25, and by Professor Anne S. Young, at South Hadley, Mass., and Mr. Frederick C. Leonard, at Chicago, Ill., on September 30.

A special number of the *Atti della R. Accademia dei Lincei* contains the report of the proceedings at the anniversary meeting last June. According to *Nature* it announces a gift of £4,000 from Dr. Gino Modigliani towards the publication of the works of Leonardo da Vinci, and a legacy to the academy of £2,000, as well as of many of her personal effects, from the estate of the late Signora Celli Dutuit. Prizes given by the King of Italy have been awarded to Professor Ernesto Manasse for mineralogy and geology, and to Professor Giuseppe Chiovenda for jurisprudence and political science. The minister of public instruction also gives four prizes, each of which has this year been divided, the recipients being Professors G. Ercolini and A.

Amerio for physics, Professors A. Quartaroli and R. Salvadori for chemistry, and Professors Enrico Carrara, Donadoni Eugenio, Levi Ezio and Ribezzo Francesco for the two philology prizes. A prize founded by Santoro is awarded to Professor Costantino Gorini for his discoveries in the bacteriology of cheese, while another most useful prize, founded by the late Alfonso Sella for assistant lecturers in the department of physics, is awarded to Dr. Paolo Rossi, of the University of Naples.

THE *Geographical Journal* states that an elaborate expedition is being organized in Germany by Lieut. Schröder-Stranz, whose original intention of carrying out a voyage of research to Novaya Zemlya and the Taimur peninsula has now given place to a proposed complete circumnavigation of northern Europe and Asia, repeating the classic achievement of Nordenskjöld in the *Vega*. Lieut. Schröder-Stranz is not, however, desirous of merely once more achieving the passage after an interval of thirty-four years, but hopes to carry out extensive scientific researches during the voyage, which is expected to last from three to four years. On the Russian side, it appears that Mr. Russanof, who has many times visited the Novaya Zemlya region, is once more planning an expedition to that country, with a view to further testing the possibilities of navigation to Siberia round its northern end. He will be accompanied by Mr. Kuchin as hydrographer. On the other hand, it is said that the opening of a sea-way to Siberia from the west does not find favor with the Russian authorities, who, however, are continuing their efforts to open regular navigation from Bering Sea to the Kolyma and Lena Rivers. The mouth of the former river is to be surveyed by Captain Grünfeld, who has already started from Yakutsk for the purpose, while the stretch of coast-water between the Kolyma and Lena is to be investigated by the well-known geologist, J. P. Tolmachef. A good deal has been heard of a proposed Russian expedition to the North Pole, under Lieut. Sedof, who has already undertaken minor expeditions to northern Siberia and Novaya Zemlya. Sedof's plan appears to be to proceed to Franz Josef Land, and thence make a sledge journey across the pole to northern Greenland. It is reported, however, that the hoped-for support of the Russian government is not likely to be afforded, and the venture must rely on private assistance only. On the Greenland side the explorer Rasmussen has prosecuted his plan, abandoned last year from force of adverse circumstances, and found traces of the missing Danish explorer, Einar Mikkelsen.

THE Italian Commission for the survey of the frontier of Italian Somaliland with Abyssinia returned to Italy in January, and some account of its operations is given in the *Geographical Journal* from *Revista Geografica Italiana*. The leader was Captain Carlo Citerni, one of the survivors of Bottego's last expedition, who was supported by Dr. B. Colonna as medical officer, and by Signors Grupelli and Venturi as topographers. The expedition set out towards the end of 1910, traveling from Jibuti to Adis Ababa, whence it was to strike southeast through an imperfectly known country to Dolo on the upper Jub, a little above Lugh. Here the survey of the frontier was to begin. During the stay at Adis Ababa a topographical survey of about twelve square miles was carried out on the scale of 1:25,000, embracing the city and its environs. The march to Dolo led by the Lagio pass from the basin of the Hawash into that of the Web, across a mountain range with summits reaching 13,000 feet and more. At Dolo observations for latitude, longitude and azimuth were taken and a base measured, after which a triangulation was carried out along the frontier zone to the northeast and a survey plotted on the scale of 1:100,000. This region had hitherto been almost a blank on the map. The work does not seem to have been continued beyond the Webi Shebeli, but on reaching this the commission returned to the coast at Brava. Besides the precise survey of the frontier, a careful traverse of the whole route from Dire Dawa (near Harrar) to Brava was carried out, and numerous astronomical determinations of latitude and longitude were made.

UNIVERSITY AND EDUCATIONAL NEWS

Mrs. Radcliffe Crocker has made a gift of £1,500 to University College Hospital to endow a traveling scholarship in dermatology in memory of her husband, Dr. H. Radcliffe Crocker, for 30 years physician to the hospital. The scholarship carries with it a gold medal, and will be awarded every five years.

In a note reprinted in Science on the number of degrees conferred by a number of American colleges and universities, Cornell University was omitted. This university conferred in 1912, 918 degrees, in 1911, 814 degrees, and in 1902, 496 degrees.

A complimentary dinner was given by President Charles F. Thwing, of Western Reserve University, at the University Club, Cleveland, on Thursday evening, October 3, in honor of students winning honors and prizes by high scholarship in Adelbert College. President Thwing's guests included twenty-nine students.

Dean Woods, of the department of agriculture of the University of Minnesota, recently declined an offer of $9,000 to become head of the agricultural department of the University of California. The regents of the University of Minnesota voted to increase his salary to $7,500.

Dr. John Fraser, assistant professor of chemistry in the University of Pennsylvania, has been elected dean of the Towne Scientific School. His father and his grandfather were both distinguished professors of chemistry in the University of Pennsylvania. Dr. William Pepper, whose appointment as dean of the medical school, has already been announced, is the son of Dr. William Pepper and the grandson of Dr. William Pepper, both of whom were distinguished professors of medicine in the university.

Professor George Herbert Palmer, Alford professor of natural religion, moral philosophy and civil polity, will be the Harvard exchange professor with the four western colleges. His term of service will fall in the second half year. The officers who will come from the western colleges in the exchange are Professor D. E. Watkins, from Knox College, Galesburg, Illinois, who will teach in the department of public speaking through the year; Professor P. F. Peck, of Grinnell College, Iowa, who will give instruction in American history in the second half year, and Professor G. H. Albright, of Colorado College, who will give instruction in mathematics. Beloit College, Wisconsin, has not yet chosen its exchange professor.

At the University of Pennsylvania Clarence Erwin McClung, Ph.D., now professor of zoology in the University of Kansas, takes the chair made vacant by the death of Dr. Thomas H. Montgomery, Jr. Robert Heywood Fernald, of the Case School of Applied Science, succeeds the late Professor Henry W. Spangler as professor of dynamic engineering.

Professor John Alden Ferguson, head of the Forest School of the University of Missouri, has returned to the Pennsylvania State College, as head of the Forest School.

Professor Olin Ferguson, of Union College, has become head of the electrical engineering department at the University of Nebraska. His place at Union College has been taken by Professor Walter L. Upson, of the University of Vermont.

Dr. Edna Carter, holder of the Sarah Berliner fellowship at the University of Würzburg in 1910–11, returns to Vassar College as associate professor in physics.

Professor O. A. Johannsen, formerly entomologist of Maine Station at Orono, has returned to Cornell University to teach in the department of biology.

To fill the vacany caused by the appointment as full professor of organic chemistry at Harvard University of Professor Elmer P. Kohler, who has been connected with Bryn Mawr College for twenty-one years, Dr. Roger F. Brunel, A.B. (Colby), Ph.D. (Hopkins), has been called from Syracuse University.

Dr. Lewis William Fetzer, of the United States Office of Experiment Stations, has been elected associate professor of chemical

physiology in the State University of Oregon Medical College at Portland. The Oregon physiological laboratories are now officered by John D. MacLaren, M.S., M.D., director; L. W. Fetzer, Ph.D., M.D., physiologic chemist; Horace Fenton, A.B., M.D., clinician; Mary V. Madigan, M.D., anesthetist; O. W. Curran, Ph.B., assistant, and J. C. Rinehart, B.S., technician.

DISCUSSION AND CORRESPONDENCE

ONE PHASE OF WASHINGTON SCIENCE

IN a presidential address[1] before the Geological Society of Washington, Mr. Alfred H. Brooks has reviewed the evolution of applied geology and sought to point out the relation of its advance to that of the science of pure geology, as well as to the evolution of economic, political and social conditions. Though the keynote of the address is made the importance of the scientific investigator having always in view a result which in some way is to improve the material condition of mankind, the address throws an interesting but perhaps wholly unintended side-light upon one phase of "Washington Science."

The address may be said to constitute both an apology for and a glorification of the almost complete exclusion of pure science from the later work of the United States Geological Survey, and the attempt is further made to show that a like metamorphism has characterized the work of our American universities during the last two decades. The concluding sentences of the address, if taken alone, might indeed seem to contradict the earlier statements of the report. They are worth quoting:

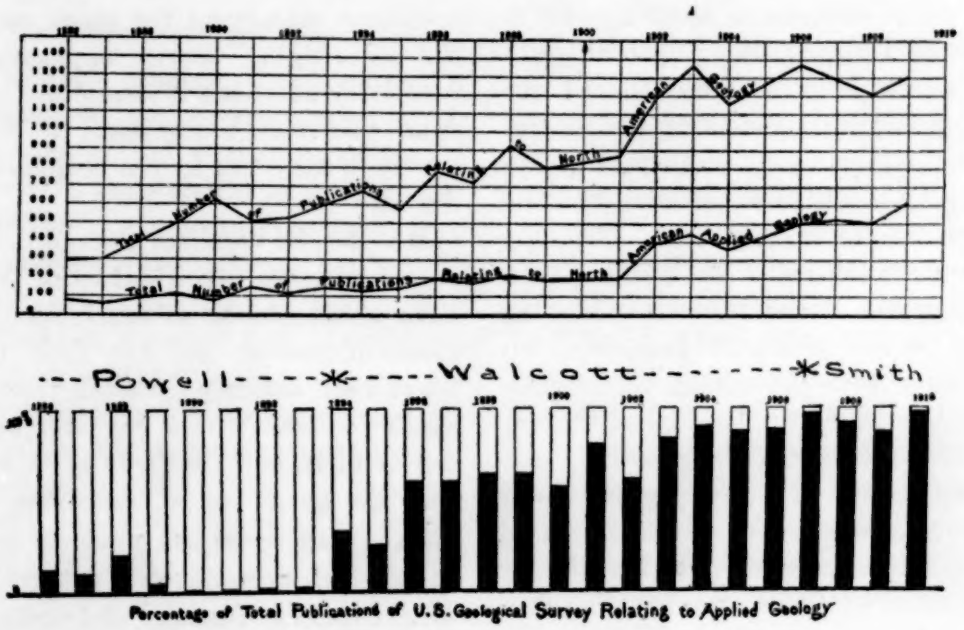

FIG. 1. Diagrams to show by annual increments the number of publications relating to North American geology and applied geology since 1886, and the percentage of total publications of the United States Geological Survey relating to applied geology during the same period.

There is, however, grave danger that, carried away by the present furor for practical results, we may lose sight of our scientific ideals. Applied geology can only maintain its present high position of usefulness by continuing the researches which advance the knowledge of basic principles.

To his address Brooks has contributed the results of an inquiry to determine what percentage of American geological publications issued during the last quarter of a century has been devoted either wholly or in part

[1] Alfred H. Brooks, "Applied Geology," presidential address delivered before the Geological Society of Washington, December 13, 1911, *Jour. Washington Acad. Sci.*, Vol. 2, No. 2, January 19, 1912, pp. 14–48.

to applied geology. His results are graphically set forth in the upper diagram of the figure. While his method is not above criticism, it probably gives a crude idea of both volume and scope of American geological publications in recent years. It is based upon a count of publications listed in the annual survey bibliography of North American Geology, the papers in pure and applied geology being separated on the basis of their titles. By the same method, a separate count was made of the publications of the U. S. Geological Survey with results reproduced in the lower diagram of the figure. Upon this diagram the reviewer has indicated the periods of the Powell, Walcott and Smith administrations of the survey, since these appear to be not without significance. This diagram shows that although in 1890 less than 1 per cent. of the publications issued by the federal survey treated either wholly or in part of applied geology, no less than 98 per cent. of those issued in 1910 were in this field. Probably the real change is somewhat less striking than the figures indicate, since pure science is often included in reports primarily economic, but no one familiar with the recent transformation of the United States Geological Survey will doubt that the figures are essentially correct. A comparison of the upper and lower diagrams furnishes a sufficient refutation of the notion that the universities of the country have degenerated by the same proportion during the period covered by the investigation.

The apology for this state of affairs, which we think every true friend of science must deplore, is made by Mr. Brooks in the following terms:

> If geologic surveys are properly a function of the state, in the last analysis the people must be the final arbiters as to what phase of science is to be emphasized. In our democracy the citizen has the right to inquire what he, as a member of the body politic, is gaining by expenditures from the public purse.

These statements, of course, ignore completely the well-recognized fact that in the long run the greatest material gains have come through basic studies in pure science and not from "hand-to-mouth" investigations which have always a definite economic end in view; as they do also the further fact that the people are not expert geologists and expect to be advised by those who are and who are employed by them. Most geologists will admit that studies in applied geology were near the close of the Powell administration somewhat too largely subordinated to larger and more fundamental investigations, and that this had much to do with the temporary setback which the survey then received; but in this there is no justification for the almost complete neglect of work in pure science which has been characteristic of later administrations. No one doubts that an entire surrender to the politician clamoring for quick returns makes the securing of survey appropriations comparatively easy, but it should not be concluded from this that the present tendency in the survey is approved by the people of the United States.

Mr. Brooks ventures the opinion that "one reason why the investigators of this continent have accomplished so much for the advancement of geology is that their research has never been entirely divorced from the field of applied science." The reviewer would venture the opinion, and the facts seem to support it, that the great era of American geology was already passing as the craze for investigations in applied geology was gathering headway. Mr. Brooks's further statement that "advances in pure science were always in more or less direct proportion to advances made in the applied sciences," would be much improved by transposing "pure science" and "applied science." We doubt the truth of the statement that "science has made most rapid strides at those times when its study was inspired by desire to achieve some practical end." The declaration that geologic research "has for its aims the application of scientific principles to the needs of man" should be prefaced by the statement, "As interpreted by the United States Geological Survey." In many quarters, we believe, its aim is still quite as much the discovery of scientific principles as their adap-

tation to the needs of man. "We are now," says Mr. Brooks, "applying science to the affairs of the nation as never before. The old-fashioned publicist with his classical education, or, at least, traditions, is being shouldered out of the way by the man who analyzes the problems of public welfare on scientific principles. . . . Yet there are not a few geologists, though I believe a constantly decreasing number, who seem to view with suspicion any attempt to make the science of geology more useful." We believe comment upon these statements would be altogether superfluous.

WM. H. HOBBS

UNIVERSITY OF MICHIGAN,
June 4, 1912

PREPARATION OF WHOLE POLLEN MOTHER CELLS

TO THE EDITOR OF SCIENCE: The brief article by Albert Mann on the preparation of whole pollen mother cells for the examination of mitotic figures, in SCIENCE for August 2, suggested that others might be interested in some experiments made along the same line by the writer during the winter of 1911–12. The technical difficulties presented by the method worked out at that time are somewhat greater than in that suggested by Mann, but the results were, on the whole, quite satisfactory.

Whole anthers, which from previous examination were known to represent the stages wanted, were fixed for 30 hours in strong chrome-acetic acid. They were then carefully washed in running water for 24 to 30 hours and gradually run up to 80 per cent. alcohol, in which they were allowed to harden for several weeks. They were then stained for 3 to 5 days in a strong cochineal tincture or in Kleinenberg's hematoxylin. The stains were rinsed off with 80 per cent. alcohol. The specimens were further dehydrated, and after resting in absolute alcohol for 6 to 8 hours were put into a mixture of equal parts of absolute alcohol and cedar oil in an open vial or small cylinder. They were allowed to remain in the open vessel on the paraffin oven until the alcohol had completely evaporated, requiring 2 to 3 days. Finally specimens were carefully dissected or teased apart in a drop of oil on a slide, and mounted by the addition of a drop of cedar-oil-balsam and a cover.

The important points are the hardening of cell walls before staining, the use of 70 per cent. alcoholic stains which do not overstain, and the gradual transfer from dehydrating to clearing and mounting medium, thus avoiding shrinkage of delicate cells. To any one acquainted with the two classes of stains the advantage of one which does not overstain to one which must be washed out for differentiation is well known, when dealing with mass staining. In trying out Mann's suggestions the writer found difficulty in preventing collapse of cells and in getting uniform results from the stains. The triple stain is especially difficult to manage in mass staining, and although a solution of Orange G. in clove oil, which gives the very best results with sections, was used, only a small portion of the material gave really satisfactory results.

Some of the stains used by the writer are new and the formulæ are given here for those who may care to try them.

Cochineal Tincture, Ammonia-acetate.—Digest 5 g. powdered cochineal with 150 c.c. 70 per cent. alcohol and 3 c.c. of glacial acetic acid at a temperature of 60–70° C. for 5 to 8 hours. Add ammonia until solution is neutral or but slightly acid and digest for 4 or 5 hours as before. Cool and filter until clear. Transfer to stain from 70 per cent. or 80 per cent. alcohol and rinse off excess with the same.

This solution does not overstain, and with material fixed in chrome-acetic acid stains chromatin lavender to violet and protoplasm a very light pink. In preparing fern prothallia for whole mounts the writer has found this to stain sperms and egg cells a violet tint with cell walls rose color.

For preliminary examination of pollen mother cells the old acetic-methyl green (5 per cent. to 10 per cent. glacial acetic acid added to a half saturated solution of methyl green in water) is the most generally useful, but it is of little value where gelatinous or slimy sap is present. For such cases the writer has found the following solution of

chloral hydrate and methyl violet of great value.

Methyl Violet—Acetic-chloral Hydrate.—To an almost saturated solution of chloral hydrate in distilled water add 10 per cent. volume of glacial acetic acid and enough dry methyl violet to make the liquid a bright violet color. This stains nuclei very quickly, and does not stain slimes so as to hinder observation.

The balsam used in mounting is oven-dried and then dissolved in pure cedar oil.

F. L. Pickett

Botanical Laboratory,
Indiana University,
August 10, 1912

Personal Registration of Family Memoranda: A Plea for the Making and Preserving of Homely Annals

Human efficiency is recognized to be the most desirable asset. Every one admits the expediency of attaining and perfecting individual capabilities.

Latent capabilities, inherent energies, are of use only when rendered available. To render them available and serviceable, are demanded full opportunities plus expert help in development and elaboration.

Conservation of inherent potentialities in all lines of natural resources has become an avowed principle in American industrial energizing. The first step in systematic procedures is to collect significant facts. Till data become numerous enough, sufficiently uniform and precise, no safe inferences and reliable conclusions can be formed. To achieve ultimate truth is only possible through intelligent, persistent and world-wide cooperation. Such methods for laying the foundations of practical certitude are being applied to most lines of endeavor and economic progress.

The one conspicuous exception is the study of human efficiency. Here methods are so lacking in system, so disproportionate, as to disappoint reasonable expectations.

Bureaus of animal industry are proceeding with excellent system and thoroughness. Their methods already serve as models; their findings form the basis for important economies.

Especially defective are the means employed for preserving significant facts bearing on the life history, physical, psychologic, domestic and other factors of personal advancement in human beings.

This conclusion was reached while initiating a research the data for which were found unattainable. Conference with leading workers in economics, psychology, anthropology, clinical medicine and other promising sources of information confirmed a growing disappointment.

Here, then, we are halted at the threshold in a quest for fundamental facts essential to enlightenment. Deplorable neglect is discovered in the one department of research from which results of the gravest importance should evolve.

Wholly inadequate are the registrations of birth, marriage, death, and especially of the accompanying circumstances. Even such bare outlines of human history as are attempted by municipalities are admittedly partial, inexact, far from complete. The churches make some effort to preserve a few facts with little difference in result.

Carelessness in this particular is nearly as pronounced among the well-to-do and presumably intelligent as among the very poor and shiftless. Upon inquiry among the more liberally endowed, it will be found that few persons take the trouble to make and preserve any sort of systematic registration of incidents and circumstances of personal history. Experts in genealogy are put to all sorts of shifts to secure information.

Archaic as it seems, the family bible is still compelled to serve more or less inexpediently for the purpose; also legal instruments, such as wills, deeds, property transfers, personal and other epistles, and the like disconnected and accidental avenues of evidence.

The whole forms a pitiable, heterogeneous, but the only available source of information in what may prove to be a vitally important direction.

Data are especially meager on three groups of subjects:

1. Antecedent personal history making for knowledge of ancestry, and inheritance, including salient characteristics of individuals and the family.

2. Earliest phenomena of growth and development, including traits, tendencies, tastes, etc., constituting "infant records," which should be carefully registered at the time of observation.

3. Personal history of each member of the family from birth to present age and from all reputable sources; not only of the phenomena of infantile and later development and changes, but also accurate data on physical and other disorders, illnesses, accidents, repairs, corrections, etc.

Only by the aid of light thus shed is it possible to form present or future determinations.

In a complete registration many other points should be covered, such as: full and accurate accounts of illnesses, injuries, peculiar physical and mental occurrences, when they occur; and, equally important, the nature and character of repairs or corrections, when made. All these are of vast utility to the individual.

The foregoing category of findings, if made of a large number of individuals and on a uniform system, would, it is obvious, constitute invaluable data for use by the scientific research worker, especially the physiologist, the psychologist, eugenist, human-economist and sundry others.

There is yet another grouping of facts deserving of encouragement: no less than what may be included in the term, "special happenings." This may embrace the whole realm of momentous incidents, memorabilia, liberally interpreted. Among these may be mentioned lines of education pursued, special types and kinds of training, evidences of predilections, aptitudes as they appear, develop or change; decisions made, purposes carried out well or ill, volitions, vocations, scholastic records, etc.

Finally it may be said, there are few or none but would welcome and make use, less or more, of such records, did they exist ready made.

Whatever is thus worthy is worth the effort to construct. It would contribute much to pleasure, satisfaction, sustained and increasing interest and self-respect.

The practical utility of such *annals* to each one is clear. As a contribution to scientific data a few thousands such would prove priceless.

I would suggest that the head of each and every family, however small, keep an accurate, succinct record of essential facts and opinions. In order that these should be uniform the book should contain carefully prepared blanks, questionnaires, memoranda of salient points, etc., which should in each instance be covered to make the records complete.

Such a family history register I have carefully outlined, with kind help from eminent specialists in biology, psychology, eugenics, economics, euthenics, clinical medicine and genealogy. No family record book has as yet been published which altogether meets popular requirements. The "life history album" of Sir Francis Galton is unsurpassed for purely scientific findings, but not adapted to popular use. There are many excellent "baby books" of limited scope, chiefly sentimental.

To serve domestic and economic as well as scientific purposes, blanks and questionnaires should cover (concisely) pretty much all points in human interests, otherwise it will be difficult to induce heads of families to realize the *practical advantages* accruing, which are of the utmost value, and to take interest in making the notes.

Wide cooperation is essential; scattered data are valueless; many thousands of facts are required.

In an ideal register several features must be included appealing to sentiment, obvious utility and commendable self-complacency. For popular acceptance certain points are desirable, comprising, among others:

Blanks for *index* (including marriages, births, deaths, dates, places, etc., with page references to additional inscriptions in the book).

Chart for genealogy (*e. g.*, to about the eighth generation—direct ascendants' names

to correspond to a number and kept on special blanks; collaterals to be registered on separate blanks).

Blanks for *baby records* (growth, development, etc., complete in physical and psychologic features, but not too exacting—extra data to be inscribed on special pages provided).

Blanks for *personal history* (of each individual of over one year of age, from birth to time of writing—later occurrences to be placed under "special happenings").

Blanks for *phenomena of attack of illness, injury or operation* (when they occur—to be filled in by physicians).

Charts for *weight and height* (also tables of standard weights and heights). Blanks for *observations and findings of specialists;* charts for *special clinical data* (eye, ear, nose, throat, etc.); blanks for *laboratory findings* (urine, feces, blood, sputum, etc.); pictorial charts for *anatomical memoranda;* blanks and charts for *dental memoranda;* special blank for *photographs* (interesting to preserve photographs at different ages, of children and adults); and, among the most important, pages for *special happenings,* notable occurrences of personal history, including memorabilia of tendencies, trends of thought, genesis and course of purpose, cherished or revealed potentialities, ideals, conduct, self-discipline, lines of development, of capacities, education, achievements, distinctions, renunciations, conservations, etc., constituting a picture of the evolution of personality.

The whole to afford accurate data, whereon alone can be based many present and future determinations, mental and voluntary processes, decisions and economies in health, mental and physical, legal and insurance precisions, inheritance, etc.

The author will be grateful for any comments, criticism and especially for encouragement.

J. Madison Taylor
Philadelphia, Pa.

Hermaphrodite Females in Lychnis Dioica

Some years ago Strasburger[1] reported that female specimens of *Melandrium rubrum* Garcke (a form of *Lychnis dioica* L.) growing in his experimental garden at Bonn, were changed to apparent hermaphrodites as a result of infection with the anther-smut, *Ustilago violacea.* The infected plants had fully developed stamens, but the sporogenous tissue of the anthers was completely replaced by the spores of the smut. Strasburger suggested that all the cases of hermaphroditism which had been occasionally reported in this species were probably due to infection by *Ustilago.*

When I discovered functional hermaphrodite mutants in *Lychnis dioica* and demonstrated by numerous genetic experiments[2] that these functional hermaphrodites are modified males, I believed that Strasburger had misinterpreted his material and that his hermaphrodites which resulted from infection by *Ustilago* were produced by the development of female organs in the male, and not as he supposed by the development of male organs in the female. Strasburger was correct, however, as to the nature of his apparent hermaphrodites, as demonstrated by two facts which he has recently pointed out,[3] namely, (*a*) that the females are not always completely infected, in which case the uninfected branches bear normal female flowers, and (*b*) that infected males show no development of the female organs.

Professor Doncaster, of the University of Cambridge, England, has tested the influence of *Ustilago violacea* upon *Lychnis dioica* by artificial infections, and his results completely corroborate the conclusions of Strasburger. He sends for publication in Science the following brief account of his experiments:

It is well known that *Lychnis vespertina* is diœcious, but that all plants infected with the fungus *Ustilago* have well-developed stamens. Some of these plants have the typical male form, without trace of ovary; others have a vestigial ovary and styles in addition to the stamens and anthers filled with *Ustilago* spores. This suggests that when a female plant is affected by the para-

[1] *Biologisches Centralblatt,* XX., 657 et seq., 1900.

[2] *Botanical Gazette,* XLIX., 110, 1910.

[3] *Jahrbuch für wissenschaftlichen Botanik,* XLVIII., 427, 1910.

site, the stamens are caused to develop and the ovary is reduced, while the form of the flower of a male which is infected is not altered. In order to test this suggestion, I planted some ustilaginized plants in my garden in the late summer of 1910, and put with them some uninfected plants which I attempted to infect by sprinkling them with spores and by rubbing spores into parts of the stem from which I had scraped away the epidermis. The results were as follows: Of seven females which I attempted to inoculate in August, 1910, one became infected, and had the typical "hermaphrodite" form of flower in October, but in June, 1911, was again quite free from *Ustilago*, and had typical female flowers. A second female plant showed infection in June, 1911, but only on part of the plant; one branch was quite clean and had typical female flowers, the rest of the plant was infected and had "hermaphrodite" flowers.

Of eight male plants which were inoculated in August, three showed some infected flowers before the end of September; the anthers contained *Ustilago* spores, but there was no change from the male type of flower. Three of these eight plants were dead in June, 1911; one of the remaining five was infected.

Of five ustilaginized plants transferred to the garden, four had the hermaphrodite type of flower and one the male. One of the hermaphrodites so far recovered in September, 1910, as to set some seed; in 1911 all were still infected. One of them had some branches with hermaphrodite flowers containing large ovary, short styles and stamens with little or no pollen, but without *Ustilago* spores, while the rest of the plant had flowers with anthers full of spores, and the ovary and styles more reduced.

These observations seem to prove that infection with *Ustilago* can turn the female flower into the apparent hermaphrodite, but that no production of female organs takes place in a male flower when it becomes infected.

L. DONCASTER

CAMBRIDGE, ENGLAND

The occurrence of uninfected hermaphrodite flowers on one of Doncaster's original infected plants may possibly indicate that this plant was not a female previous to its infection, but a hermaphrodite. If it were possible to secure pollen from a ustilaginized female, certain genetic problems of very great interest might be solved. It is of great theoretic importance to know whether infection by *Ustilago* affects the genotypic nature of the host. If the effect is purely somatic, as seems to me the more probable, the offspring of a self-fertilized hermaphroditic female, or of a normal female fertilized by sperms from a hermaphroditic female, should consist only of females (if uninfected), and not of females and hermaphrodites, as I have shown to be the case when a female is fertilized by a hermaphroditic male. If infection by *Ustilago* produces a genotypic modification, it would be interesting to know whether such induced hermaphrodites are homozygous like the females by whose modification they are produced; they should in that case yield only hermaphrodite offspring. Hermaphroditic males produce both female and hermaphroditic male offspring, because the males are sex-heterozygotes.

As I have been fortunate enough thus far not to have a single infection from *Ustilago* among the many thousands of individuals of *Lychnis dioica* which have been involved in my cultures during the past seven years, I do not care to take up at present the here suggested line of investigation upon ustilaginized females. I do not wish to jeopardize by importing infected material, the solution of many other genetic problems now under investigation, but I hope that Professor Doncaster or some one else who is in a position to do so, will give attention to breeding from hermaphroditic females if this proves to be technically possible.

GEO. H. SHULL

SCIENTIFIC JOURNALS AND ARTICLES

CONTENTS of the September number of *Terrestrial Magnetism and Atmospheric Electricity* are as follows: "A New Type of Compass Declinometer," R. L. Faris; "The Physical Theory of the Earth's Magnetic and Electric Phenomena, No. VI.: On the Origin of the Earth's Magnetic Field," L. A. Bauer; "Magnetic Declinations and Chart Corrections Obtained by the *Carnegie* from Batavia to Manila, and Thence to Suva, Fiji, November, 1911, to June 5, 1912," L. A. Bauer and W. J. Peters; "Resultate der Inklinationsbeobacht-

ungen der Deutschen Südpolar Expedition 1901 bis 1903," Fr. Bidlingmaier; "Regarding Magnetic Records Obtained in Cooperation with Captain Scott's Antarctic Expedition," C. Chree; "Magnetic Character of Days as Observed at the Cheltenham Magnetic Observatory, April 1 to June 30, 1912," G. M. T., O. H. Tittmann; "The Magnetic Character of the Year 1911," G. van Dijk; "Levé Magnétique der Bassin du Rio S. Francisco," H. Morize; "Observation of the Magnetic Declination at Warsaw during the Solar Eclipse of April 17, 1912," S. Kalinowski; "On the Movement of Inertia of Long Magnet H 26 at the Cheltenham Magnetic Observatory." R. L. Faris; Abstracts and Reviews.

SCIENTIFIC BOOKS

The Influence of a Magnetic Field upon the Spark Spectra of Iron and Titanium. By Arthur S. King. Publication No. 153. Carnegie Institution of Washington.

It is assumed that the readers are familiar with line spectra produced by luminous rays from dissociated particles of the metals. Most readers will also be familiar with the following fact, viz., when these lines are produced in a magnetic field they break up into three or more components. This is called the Zeeman effect.

By reason of Hale's epoch-making discovery of a Zeeman effect in solar lines, this phenomenon has come to have a large interest to astrophysicists as well as to physicists. This iron and titanium study should particularly appeal to the former.

The Zeeman effect is much more complicated than the simple theory first indicated. The separations differ in magnitude, number of components, relative spacing of the components, relative intensity and relative sharpness. Farther, the intensity of some of the components is relatively increased (enhanced) with respect to the original line, others are relatively decreased. All of these items are important in the determination of spectral series and in arriving at the physical condition of the luminous particles. Each spectral series generally shows but one type of separation. Furthermore, some of these types repeat from substance to substance, showing an intimate electronic relationship in the molecule of different substances. The phenomenon grows very complex in the detailed study of the different elements. The "Zeeman effect" and spectral series stand almost alone in showing us what a wonderful complex structure exists within every atom. Not all the complexities of the phenomena have been explained. Still, theory has kept well apace with the observations and has often pointed out the way. So important in the latter respect has been some of the contributions by Ritz, that I should like to add at least one of his contributions[1] to the very complete bibliography given by Mr. King.

While all the above characteristics are important no observer has recorded them all, not caring to encumber his data with detail which is not immediately fruitful. Likewise there is much curtailing of the computations. In a paper published by the Carnegie Institution, it seems to me that items of possible future as well as present value might be recorded and save a great amount of labor.

The components of many lines lie so very close together that it is necessary to separate the two kinds of vibrations by some polarizing device, and photograph each separately. The very important relation of the intensity of these kinds of vibration can not then be found accurately since it is impossible to maintain light at the same intensity for the two exposures. But it occurs to me that, with the non-astigmatic Littrow spectroscope which Mr. King has used, one could focus the double image of an interposed calcite upon the slit and photograph both kinds of vibrations coincidently in juxtaposition.

Particularly among the several component lines, there seems to be a certain degree of order. They are often stepped off in uniform spaces. These steps differ in magnitude from line to line, but all seem to be simple fractional parts of a standard value, called the normal, *a*. Furthermore, this "normal" has the value we should expect from the ratio of

[1] *Ann. d. Physik*, 25, 660, 1908.

electrical charge to the mass of the simple electron. This has been interpreted to mean that the rotating (vibrating) electron does not produce an appreciable magnetic field but that the complexity arises from "linkage" of the electrons in different ways. I will illustrate this simplicity of step arrangement by citing from Mr. King's work three iron lines, viz., 3722.7 λ, 3872.6 λ and 5447.1 λ. The spacings are all "normal" and the steps are (1, 2, 3, 4) for one kind of vibration and 1, 2, for the other kind of vibration so that King writes the line ± (1, 1, 2, 2, 3, 4) *a*. From his tabulated measurements I have computed the value *a*, and find it for the three lines to be respectively .730 ± .008, .752 ± .006 and .758 ± .006, whereas his field strength would give .753. One notices but a slight deviation in the first, which arose from a probable error in one measurement. These little details in computation may add much to the conclusiveness of a statement. Neither such simplicity nor so conclusive a relationship is present in the twelve component thorium line 4086.7 λ.[2]

For most substances the majority of lines are triplets, which corresponds to the simplest form of the theory developed by and predicted by Lorentz. However, these triplets show great variety in magnitude and appearance.[3] Mr. King thinks there is some tendency for these lines to group about magnitudes related to the "normal." For example, he finds that thirty-five sharp lines (Table IV.) can be grouped under the magnitude $3a(=2.26)$. I find twenty of these lines to lie between 2.21 and 2.32 with an average of 2.275. This is a difference of five per cent. in the extremes. For a considerable distance upon either side of this space (2.21 to 2.32) there are but few lines of corresponding sharpness. This fact seems favorable to a single group in this list. But the real necessity here is the same as I pointed out in case of thorium, viz., a little greater accuracy (or greater resolving power of the spectroscope). For example, reduce this extreme error in variation from five to one per cent., possibly even two per cent., then we shall know whether there are steps in the magnitude of the triplet separations or whether there are a great variety of separations differing by small increments of value. The latter result implies that the electrons are vibrating in a self induced, as well as the superimposed magnetic field.

I fail to see the validity of Mr. King's law (p. 54): "*Since* $D\lambda/\lambda^2$ (*i. e.*, change in frequency of vibration per sec.) *is shown to be nearly a constant, . . . the mean separation of the n-Components* (*i. e.*, components which vibrate perpendicular to the lines of force) *varies as the square of the wave length.*" The notes in parentheses are added by way of explanation. One thing made certain by experiment and theory is that different types of separation correspond to different physical aggregates, unions, or "linkages" of electrons; and Preston's law shows that any *single type* may repeat itself in lines throughout the spectrum, according to this *very* law that King enunciates. That the mean of all types should give a uniform value throughout the spectrum, implies only that all types are fairly well distributed throughout the spectrum. Such a statement has no particular value. For in a chance distribution, by the law of probabilities, such uniformity must increase as the number of lines increase. Mr. King's Table VII. shows this.

The most important place in Mr. King's paper is given to a discussion of the relation of the magnetic separation to a displacement in the position of the spectral lines which arises when the radiating particles are subjected to an external pressure. The latter is a well-known phenomenon. However, no explanation of it has found extended acceptance. Humphrey's theory involves a strong magnetic field induced by the rotating electrons. As observed above, such a field is by no means certain. But this theory and the prominence of both phenomena in solar lines form the principal reasons for an examination of their possible relationship. Tables XI. and XII. show the ratio of the two quantities for different lines to vary twenty-five fold. Then at

[2] *Astrophysical Journal*, XXX., p. 151, 1909.

[3] See King's references to Purvis, Moore, Jack, Cotton and Babcock.

once one would infer there is no relationship between the phenomena. However, Mr. King analyzes the lines by subdividing them into groups, and concludes "that a close correspondence does not exist, but there is a general agreement as to magnitude of the two effects when the means of a large number of lines are considered." I should like to add, that the "means of a large number of lines," leaves much to be desired in the proof of a relationship. Mr. King's method of subdivision carries with it another suggestion. When he divides the separations into small, medium and large, he reduces the number of types of separation in each class. For clearly a line whose separation is small does not belong to the same type as one whose separation is large. Again he selects the ratio of each of three subdivisions to low, medium and high displacement respectively. This gives arbitrarily nine divisions. By this method he shows there is an approach toward uniformity in relative magnitude. The suggestion is, what may we expect when these groups are broken up into real series types? Comparing the three iron lines mentioned above gives nothing of promise, although close measurement may show two of them to agree. But in the absence of an established series one can not affirm that these lines belong together. If this point has any merit, it would be worth while to compare substances among whose lines definite series have been established.

The tabulated data for the author's two substances lack just one thing, viz., the ultraviolet spectrum, to make them the most complete study which has appeared.

B. E. Moore

University of Nebraska,
August, 1912

Introduction to General Thermodynamics. By Professor Henry A. Perkins, Trinity College, Hartford. Wiley and Sons.

Recognizing the lack of suitable text-books in English on thermodynamics for students of physical chemistry, the author in writing this book has attempted to make good the deficiency.

The volume comprises some 225 pages of octavo size subdivided into eight chapters, the titles of which in order are: General Heat Relations; The First and Second Laws of Thermodynamics; Entropy; Thermodynamic Equations; Perfect Gases; Real Gases; Change of State; The Solution of Problems. At the end of the book there are eight tables giving gas constants, thermoelectric and calorimetric constants of certain substances, density and thermo-elastic coefficients of certain liquids and solids, critical and Van der Waals constants, coefficients of expansion of gases and relation of pressure units in various systems.

The methods of presentation and demonstration employed by the author are for the most part classical and it is therefore unnecessary to refer to them specifically. The emphasis laid upon the doctrine of available energy as a means of interpretation of the second law is notable. The various thermodynamic potentials and the phase rule of Gibbs receive appropriate attention. The last chapter is noteworthy on account of the large number of problems which are proposed for solution by the student. Solutions of typical problems are given.

The scope of the book appears to be quite adequate for the purposes which the author has in view. A remarkable amount of material is condensed into a small volume through the aid of mathematical expressions; and although the demands made upon the mathematical knowledge of the reader are not very great it would appear that the author probably intends the book to be used by students having the advantage of a competent instructor. Professor Perkins has, in writing this book, furnished a valuable addition to the English text-book literature of thermodynamics.

A. P. Wills

Astronomy in a Nutshell. By Garrett P. Serviss. Illustrated. G. P. Putnam's Sons. 1912. Pp. xi + 261.

There are so many excellent popular books on astronomy and its different branches, that

a new work is unnecessary unless the author has new material to present or can place before the reader the old facts in a novel and interesting form. Judged on these lines, this book of Mr. Serviss is wholly unnecessary: it presents old material in a stereotyped, uninteresting and unattractive form. The explanations of many of the motions of the solar system are obscure, and fail to give the reader an adequate understanding of the underlying principles involved.

The book contains many illustrations, but the pictures in most cases bear no relation to the accompanying text. Photographs of the surface of the moon are scattered through the chapter devoted to definitions and explanations of such astronomical terms as horizon, zenith, altitude and azimuth; while amid the pages devoted to a description of the moon appear photographs of various nebulæ.

CHARLES LANE POOR

A Beginner's Star-book. By KELVIN MCKREADY. G. P. Putnam's Sons. 1912. Illustrated. Pp. vii + 148.

This little book is a beautifully printed and illustrated guide to the stars and star groups. The star charts and key maps, intended as guides for the amateur observer, are arranged on a somewhat novel plan. For each season of the year two charts are printed, one showing the sky as the observer faces the south, the other the sky as the observer faces the north. This undoubtedly facilitates the finding of those stars situated either directly north or south and not too high above the horizon. But the charts are rather confusing when the star one seeks to locate is nearly overhead, or far to the east or west.

The illustrations, showing the principal nebulæ and star groups of the heavens, are from photographs taken at the Yerkes Observatory, and are wonderful reproductions and triumphs of the printer's art. As a whole, the book is admirably adapted for its purpose, and should interest many in the study of the heavens.

CHARLES LANE POOR

SPECIAL ARTICLES

UROPHLYCTIS ALFALFÆ, A FUNGUS DISEASE OF ALFALFA OCCURRING IN OREGON

EARLY in the year 1910 the writer noted the occurrence of a crown gall disease of alfalfa in the Rogue River Valley near Medford, Oregon, but, on account of other pressing work, the character of the disease was not investigated until later. However, during 1911, owing to the fact that the disease began to show rather seriously in many of the large alfalfa fields, an investigation was begun and considerable field and laboratory work was done. An examination of a large number of fields with plants from two to seven years of age showed large areas where the plants had died, or where the growth had become very weak. On examining the plants within these areas, it was found that the crown and part of the stems just above the crowns were badly infected with numerous galls, varying from an eighth of an inch or less to sometimes four inches in diameter. These galls are much warted externally, and more often a large-appearing gall is made up of a number of smaller galls which have become united. Very rarely were there any galls found on the root system, and none at more than six inches below the surface of the ground as the plants stood in the field. The disease seems to affect the shoots or stems as well as the crowns and roots, and many specimens were found where the galls covered the stems fully five or six inches above the crowns. In the field, diseased plants usually show a very roughened crown from which only weak, chlorotic stems arise, the leaflets also being very small and lacking the normal green color. In the few references which the writer has had the opportunity to see, and which are cited below, it has been stated that the fungus was observed to be most destructive to plants on damp ground. My investigations have shown that this is not true. It has been found that even in the best drained sandy loam and gravel soils of this district (Rogue River Valley) the disease is quite as serious as in the heavy, poorly drained, "sticky" soils. It has been deter-

mined that most of the serious injury attributed to disease in the heavy soils is, after all, due to lack of drainage. An examination of the root system of plants not diseased shows that the root system penetrates only a short distance, and the root terminals, instead of being tapered, have a rounded or blunt appearance.

CAUSE OF THE DISEASE

A microscopic examination of the galls shows the disease to be due to *Urophlyctis alfalfæ* (v. Lagerh.) P. Magnus. The galls are merely hypertrophied tissue of the host plant, and contain minute cavities which are filled with masses of the brown resting spores which measure approximately 40 micromillimeters in diameter. The fungus belongs to the Class Chlorophyceæ, Order Protococcales, Family Chytridiaceæ, Subfamily Olpidiæ. The sexual resting spores are formed by the union of two sporangia and the passing of the contents of one into the other. The mycelium which produces several fruiting bodies en masse is more or less developed. The fruiting bodies are almost spherical and brownish in color.

This disease was first recorded in 1892 by Lagerheim, who found it in Ecuador. He, however, placed the parasitic fungus in the genus *Cladochytrium*. Magnus, in 1902, found it in Alsace, Germany, and referred the fungus to the genus *Urophlyctis*. Until 1909, the disease had not been reported in the United States, although it had been found in South America, Germany, England and other foreign countries. In 1909, it was reported from both California and Arizona. A year later the writer found it in southern Oregon, but nothing was published until 1911, when a preliminary statement was made which appeared in the local press.

During the past season the writer has been doing considerable work on the histological effect of the fungus, as well as the determination of the manner of natural infection, etc. A detailed paper will be published later.

The literature on this disease is not very extensive; the references which the writer has at hand are as follows:

von Lagerheim, G., "Mykologische Studien. I., Beiträge zur Kenntniss der parasitischen Pilze," 1–3. *Bihang till K. Svenska Vet.-Akad. Handlingar.*, Bd. 24, 1898, Afd. III., No. 4. Abstract in *Centbl. Bakt.* (etc.), II., 5, 558–560.

Magnus, P., "Ueber die in den knolligen Wurzelauswuchsen der Luzerne lebende *Urophlyctis*." *Ber. deut. bot. Gesell.*, 20, 291–296. 1902.

Salmon, E. S., "*Urophlyctis alfalfæ*, a Fungous Disease of Lucerne in England." *Gard. Chron.*, III., 39, 122. February 24, 1906.

Smith, Elizabeth H., "A Note on *Urophlyctis alfalfæ* (v. Lagerh.) P. Magnus, in California." Science, N. S., Vol. XXX., No. 763. August 13, 1909.

Smith, Elizabeth H., "A Note on *Urophlyctis alfalfæ* in California." Experiment Station Record, Vol. 21, No. 6, November, 1909.

McCallum, W. B. (Plant Physiology and Pathology). Arizona Station Report, June 30, 1909.

McCallum, W. B. (Work in Plant Pathology). Experiment Station Record, Vol. 23, No. 7, December, 1910.

O'Gara, P. J., "*Urophlyctis alfalfæ*, a Crown Gall Disease of Alfalfa New to Oregon." Medford *Mail-Tribune*, August 29, 1911.

P. J. O'Gara

Office of the Pathologist,
Medford, Oregon

A COMPARISON OF THE "MAMMOTH" AND SPANISH PEANUTS AS GROWN IN CENTRAL IOWA

In the spring of 1911, the writer procured seeds of two varieties of peanuts, a strain of the Virginia peanut known as the "Mammoth" and advertised as combining earliness and large size and as being very prolific, and the small Spanish peanut. The "Mammoth" peanut seed was obtained from the Mills Seed Co., Washington, Iowa, and the Spanish peanut from Burpee, of Philadelphia. Both kinds were planted the same day, May 8, and in neighboring rows in a rich soil, which was not, however, a good peanut soil, as it was rather heavy and liable to cement and run together. Both kinds received the same treatment and were gathered the same date, October 23, the date of the first killing frost, unusually late for this section.

The Mammoth peanut hills were only a few in number. They made much higher, larger stalks and were inclined to spread over

the ground more. They bore the peanuts rather loosely scattered, so that although they were not exactly the running type of plant one had to go over considerable ground to get the crop. They continued blooming profusely until frost and although the majority of peanuts were ripe they were found in all stages from the blossom to the fully ripened nuts. Of the few plants raised and examined the most prolific bore 26 nuts, the least fruitful 19, with an average of 21 per vine.

The Spanish peanuts bore their nuts in dense clusters all set close to the main stem, so they were much more easily gathered. Though they still continued to blossom at frost, the great majority of the nuts had ripened very solid and firm and a few had actually germinated so that young plants were breaking the soil when gathered. The most prolific plant bore 82 nuts, the least fruitful is somewhat doubtful as the plants had broken up somewhat. A stalk, very likely a broken branch, bore only 10 nuts, but the least prolific entire plant bore 23 nuts, the average number of nuts per plant being 53 per vine, or considerably over twice the yield of the Mammoth.

The nuts of the Mammoth peanuts were not so immense as some of the Burpee New Mammoth Bush Peanut seen several years ago, and the hulls were not so thick; however, they were somewhat larger than the common Virginia peanut of the markets. The following figures give the result of weighing and measuring a lot taken at random:

WEIGHTS, MEASUREMENTS, ETC., OF "MAMMOTH" PEANUTS

Measurement of Nuts			Measurement of Kernels		
Serial No.	Length, Mm.	Diam., Mm.	Serial No.	Length, Mm.	Diam., Mm.
1	44	17	1	23	12
2	46.5	16	2	20	10
3	48	14.5	3	21	10
4	49.5	17.5	4	20	9
5	46	17	5	21.5	9
6	42	15	6	22	9
7	45	19	7	18	9
8	50.5	16.5	8	20.5	8
9	42	16	9	21	9.5
10	45	14.5	10	23	9
Av.	45.85	16.3	Av.	21.0	9.45

It took 20 peanuts of this variety to weigh 50 grams; of these 5 peanuts were wholly bad, and the 20 nuts yielded 33 kernels, of which 8 were shrivelled, leaving 25 good kernels; the 33 kernels weighed 30.7 grams, or 61.4 per cent. of the entire weight of the nuts.

WEIGHTS, MEASUREMENTS, ETC., OF SPANISH PEANUTS

Measurement of Nuts			Measurement of Kernels		
Serial No.	Length, Mm.	Diam., Mm.	Serial No.	Length, Mm.	Diam., Mm.
1	24	10	1	13.5	9.5
2	24	11	2	12	8
3	24	11	3	11	8.5
4	24	12	4	11	8.5
5	25	11	5	12	9
6	26	10.5	6	10	8
7	25	10.5	7	11	8
8	25.5	11	8	12	7.5
9	28	11	9	13	8
10	24.5	12	10	10	8
Av.	25.0	11.00	Av.	11.55	8.3

It required 47 of these peanuts to weigh 50 grams. All the peanuts were good, and produced 91 kernels, of which only 1 was shrivelled. The weight of these kernels was 38.5 grams, or 77 per cent. of the entire weight of nuts.

Comparing plant by plant of the 2 varieties, the average plant of the Mammoth peanut yielded 21 peanuts, weighing just a trifle over 50 grams. Of these, about 5 would be unripe or otherwise bad, and one would get 30 kernels weighing about 30 grams. Of the Spanish variety the average plant yielded 53 nuts weighing about 56.4 grams, the whole amounting to 102 kernels, weighing in the aggregate 43.1 grams.

Comparing the net output then in kernels, the Mammoth peanut yields 30 grams to 43.1 grams yielded by the Spanish peanut, or a little over 68 per cent. as much.

At the outset, it appears that the Spanish peanut, which is so much more easily gathered and yields so much more heavily, would be the most desirable form to cultivate. On account of the more compact habit it could in-

deed be planted somewhat closer and the yield correspondingly increased.

A comparison of the nuts yielded by the two varieties shows points of favor for each one. The Mammoth nuts are much larger and handsomer and would be more attractive on the market. This is offset by the fact that the shells are much thicker and the kernels do not wholly fill the cavities but rattle around loosely, while the Spanish peanut has a paper-thin shell, closely surrounding the kernel, so that there is no waste space. The kernel of the Spanish peanut is short, almost like a pea, and remarkably solid.

An unexpected difference, much to the advantage of the larger peanut, lies in the labor involved in shelling the nuts. The thin, close-fitting shell of the Spanish peanut makes it exceedingly hard to shell the kernels rapidly, while this process is easy in the larger nuts. The extra work required when the Spanish nuts are to be shelled by hand more than offsets the ease in harvesting them.

Which variety would be most desirable to grow depends upon conditions. Where the season was rather short the Spanish would be better, and where the peanuts were raised for pig-pasture it would be much superior, as the only disadvantage of the Spanish nut, that of the labor of shelling the kernels, would here not be considered.

The purpose of taking the diameter of the nuts and kernels was to show the difference in waste as regards cross-section. The shells differed markedly in thickness, and this could not be satisfactorily compared, as the irregularities made such measurements of little value in themselves; moreover, there was an empty space between the kernel and shell of the Mammoth variety to be taken into consideration. The measurements of whole nuts and kernels show that the diameter of the kernel of the Mammoth peanut was about 58 per cent. that of the entire nut, while in the Spanish peanut it was a little over 75 per cent.

H. Walton Clark

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Contact Action of Gabbro on Granite in Warren County, New York.[1]

While engaged in detailed field-work on the North Creek (Warren county) New York quadrangle, the writer found a fine example of contact action of gabbro on granite, which it is the purpose of this paper to describe.

The rocks of the region are all pre-Cambrian and these, named in relative order of ages, comprise the Grenville sedimentary series of various gneisses, limestone, and quartzite; the great syenite-granite intrusive masses; gabbro stocks or dikes; pegmatite dikes; and diabase dikes. The Grenville and syenite-granite series are highly metamorphosed and clearly gneissoid; the gabbro is only moderately metamorphosed; while the pegmatite and diabase are wholly unaltered.

The gabbro, which is of special interest here, almost invariably occurs in the form of small stocks or bosses (rarely as dikes) which break through the country rock (Grenville, syenite, or granite) in vertical, plug-like or pipe-like forms which on the geologic map show elliptical or nearly circular ground-plans. The gabbros are generally medium to coarse-grained, always holocrystalline, and they show every evidence of having been intruded under true plutonic conditions.

The contact metamorphism here described may be seen at the southern end of the gabbro stock (length ¾ of a mile) which lies just south of Mountain Spring lake or at a point 2 miles southwest of Pottersville. In a recently opened stone quarry, about 75 feet higher than the road on its east side, the rocks are laid bare in such a manner as to afford an excellent opportunity for the study of the contact zones.

The following nine zones, passing from the typical gabbro to the typical granite (country rock), have been studied in detail in the field and by means of thin-sections and hand-specimens:

[1] Published by permission of Dr. J. M. Clarke, New York State Geologist.

Zone 1.—Typical gabbro well within the gabbro stock. Nearly black, medium grained, and with diabasic texture. (Gradation from 1 to 2.)

Zone 2.—Syenitic phase of the gabbro stock and within a few feet of the granite. Dark gray, medium grained, and with granitoid texture. (Gradation from 2 to 3.)

Zone 3.—1 to 3 feet wide. Biotite-schist allel to the main contact. (Not very sharp contact between 7 and 8.)

Zone 8.—7 feet wide. Monzonitic phase of the country rock. Light gray, fairly coarse grained, and not banded. (Gradation from 8 to 9.)

Zone 9.—Typical (country rock) granite. Pink, medium grained, and very gneissoid, but with gneissic bands striking at almost right angles to the main contact.

MINERALOGICAL COMPOSITION OF EACH CONTACT ZONE

Zone No.	Ortho-clase	Micro-porthite	Micro-cline	Plagioclase	Horn-blende	Hypers-thene	Quartz	Biotite	Magne-tite	Zircon	Zoisite	Pyrite	Garnet
1	5			Ol -Lab. 45	14	20		6	2			1	2
2	32			Ol.-Lab. 10	45			6	2	little		little	5
3	Biotite-schist with some feldspar												
4	Like No. 6												
5	28			Ol.-And. 50	20		1		½	little	little		
6	15			Ol.-And. 5	72				7	½	½	little	
7	Like No. 5												
8	33			Ol.-And. 55	10		1			½	½	little	
9	40	15	4	Ol.-And. 5	5		30		½	little			½

border phase of the gabbro stock. Secondary origin. (Sharp contact between 3 and 4 gabbro and granite.)

Zone 4.—4 inches wide. Hornblendite phase of the country rock (granite). Nearly black, medium grained, banded parallel to the gabbro-granite contact. (Fairly sharp contact between 4 and 5.)

Zone 5.—6 inches wide. Monzonitic phase of the country rock. Yellowish gray, medium to coarse grained, and banded parallel to the main contact. (Not very sharp contact between 5 and 6.)

Zone 6.—15 to 18 inches wide. Chiefly hornblendite phase of the granite, but with numerous very narrow streaks of No. 5. Nearly black, medium grained, and banded parallel to the main contact. (Sharp contact between 6 and 7.)

Zone 7.—3½ feet wide. Monzonitic phase of the country rock like No. 5. Yellowish gray, fairly coarse grained, and banded parallel to the main contact. (Sharp contact between 7 and 8.)

A noteworthy feature is the fact that the strike of the foliation of the very gneissoid country rock is nearly at right angles to the gabbro-granite contact, while the clearly defined contact zones are parallel to the contact.

Other features of special interest are the syenitic border (except for the secondary biotite-schist) of the gabbro near the contact, and the almost complete absence of quartz from the granite within a dozen feet of the main contact. Thus the country rock (granite) is distinctly more basic near the contact, while the gabbro is distinctly more acidic near the contact.

Whether these interesting endomorphic and exomorphic changes are to be accounted for on the basis of assimilation of some of the country rock during the intrusion of the gabbro, or on the basis of the action of vapors from the intrusive, it at least appears quite certain that the gabbro must have been considerably superheated in order to have so

notably affected the granite. As judged by the mode of occurrence of the gabbro stock, the stoping hypothesis recently advocated by Daly or the hypothesis of marginal assimilation might be applied to account for the more acidic border phase of the gabbro, but the sharp contact of the gabbro against the granite would seem to preclude the possibility of accounting for the more basic contact zones of the country (granite) rock on the basis of actual assimilation of some of the granite by the gabbro.

William J. Miller

SOCIETIES AND ACADEMIES

THE AMERICAN MATHEMATICAL SOCIETY

The nineteenth summer meeting of the American Mathematical Society was held at the University of Pennsylvania on Tuesday and Wednesday, September 10–11, extending through two sessions on Tuesday and a morning session on Wednesday. Twenty-nine members were in attendance. Ex-President H. S. White occupied the chair, being relieved by Professors E. S. Crawley and E. W. Davis. The council announced the election of the following new members: Professor W. A. Bratton, Whitman College; Professor Florence P. Lewis, Goucher College; Mr. Leslie MacDill, Indiana University; Professor H. W. March, University of Wisconsin; Mr. M. R. Richardson, University of Chicago; Dr. J. I. Tracey, Johns Hopkins University; Mr. H. S. Vandiver, Philadelphia, Pa. Five applications for membership were received.

On both days of the meeting luncheon was provided by the university. On Tuesday evening twenty-six of the members gathered at the usual dinner. The interval between the sessions was devoted to an inspection of the university grounds and buildings. On Wednesday afternoon several of the members made an automobile excursion about the city. At the close of the meeting a resolution was adopted expressing the thanks of the society for the generous hospitality of the university.

The following papers were read at this meeting:

R. D. Carmichael: "On the theory of relativity: analysis of the postulates."

F. H. Safford: "An irrational transformation of the Weierstrass γ-function curves."

E. L. Dodd: "The least square method grounded with the aid of an orthogonal transformation."

E. L. Dodd: "The probability of the arithmetic mean compared with that of certain other functions of the measurements."

H. Blumberg: "Algebraic properties of linear homogeneous differential expressions."

J. E. Rowe: "The relation between tangents and osculant $(n-1)$-ics of rational plane curves."

H. H. Mitchell: "Determination of all primitive collineation groups in $n(>4)$ variables which contain homologies."

Arthur Ranum: "Lobachefskian polygons trigonometrically equivalent to the triangle."

G. A. Miller: "A few theorems relating to Sylow subgroups."

Anna J. Pell: "Linear equations in infinitely many unknowns."

L. B. Robinson: "Invariants of two tetrahedra."

F. R. Sharpe: "The Klein-Ciani quartic."

F. R. Sharpe: "The $(2-1)$ ternary correspondence with a sextic curve of branch points."

F. R. Sharpe and F. M. Morgan: "A type of quartic surface invariant under a non-linear transformation of period 3."

S. Lefschetz: "Double curves of surfaces projected from S_4."

H. Blumberg: "Sets of postulates for the rational, the real and the complex numbers."

Oswald Veblen: "Decomposition of an n-space by a polyhedron."

F. N. Cole: "The triad systems of thirteen letters."

H. S. White: "Triple systems as transformations, and their paths among triads."

L. C. Karpinski: "Augrim stones."

Dunham Jackson: "On the approximate representation of an indefinite integral."

T. H. Gronwall: "Some special boundary problems in the theory of harmonic functions."

T. H. Gronwall: "On analytic functions of constant modulus on a given contour."

T. H. Gronwall: "On series of spherical harmonics."

O. E. Glenn: "A general theorem on upper and lower limits for the order of a factor of a p-ary form with polynomial coefficients."

E. J. Wilczynski: "On a certain class of self-projective surfaces."

The next meeting of the society will be held at Columbia University on Saturday, October 26. The San Francisco Section will meet at the University of California on the same day.

F. N. Cole,
Secretary